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MARCH 19
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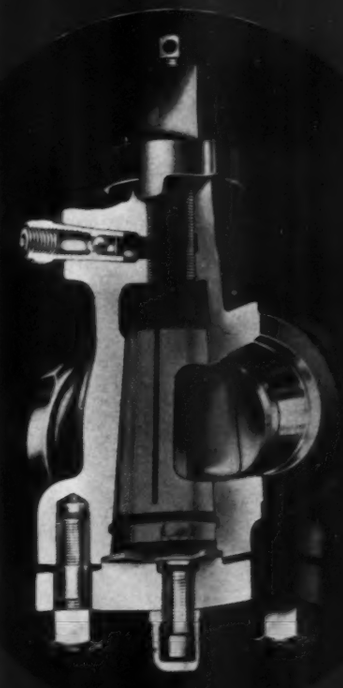
Nordstrom Hypreseal Valves on orifice meter setting and by-pass. Note the Emco Orifice Meter. An excellent combination for line control and accurate recording.

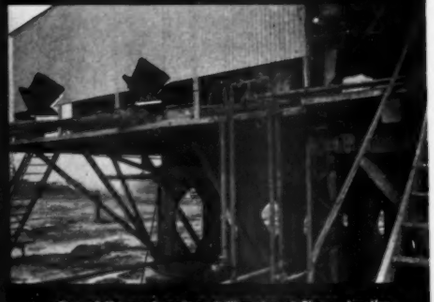
Nordstrom Hypreseal Valves on mud line to stand pipe at drilling well at Pierce Junction, Texas. Nordstrom Nordco steel valves are shown on water lines.

Nordstrom Hypreseal Valves and Nordstrom Nordco steel valves on drilling lines of one of the World's deepest wells in Upton County, Texas.

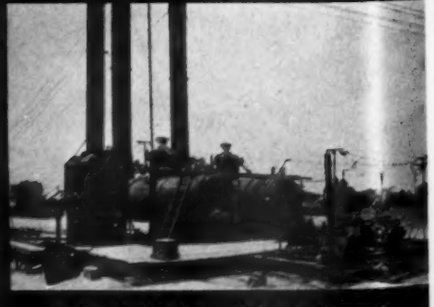


...to meet new-day drilling demands

Drilling rig in Andrews County, Texas, showing 10-in. geared Nordstrom Valve on suction line and 3-in. Nordstrom Hypreseal Valves (2000 w. p.) on mud lines.



One of the most modern drilling rigs at Pierce Junction, Texas, showing mud line with Hypreseal Valve and 2-in. Nordstroms on steam and water lines.



An efficient boiler hook-up completely equipped with Nordstrom Valves. Steam line from Superheater to pumps (350° Fahr.) controlled by Hypreseal Valve.

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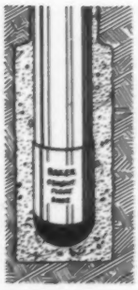
Scraper enlarging 20 to 50 feet of hole just above bottom.

This insures ample clearance around shoe and casing and permits complete distribution of cement. Then carry through to best cementing results with a Baker Cement Float Shoe a Baker Cement



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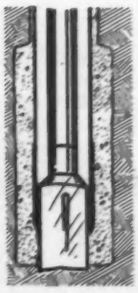

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Hot Oil Bargains Seem to Be Vanishing

AN INCONSPICUOUS report from East Texas this week bristles with interest when it is viewed against the unpleasant background thrown up in that area during its first five years of activity. The report is merely one to the effect that 6,000 barrels of confiscated crude, eligible for intrastate movement only, brought 93 cents a barrel at a receivership sale. Still fresh in memory is the posted price of 10 cents. And scarcely 18 months ago refiners were paying around 25 cents for East Texas hot oil, making from it gasoline which they sold at 2½ cents or less, demoralizing the whole market structure, especially that in Texas.

New problems, new goals and a daily shifting outlook make it easy for the swift-moving oil industry to lose sight of the solid achievement which this routine receivership transaction implies. For one thing, it is quite clear that cheap hot oil no longer is available. For another, here is impressive evidence of what voluntary effort, intelligently directed, can accomplish in the way of stabilization.

The Bureau of Mines report for January tends to confirm an opinion at which refining and marketing divisions are arriving, that abnormal weather in that month and February did not injure the oil business as seriously as had been believed.

A wildcat in Emerson Township, Gratiot County, Mich., with 1,000 feet of oil in the hole from the Dundee sand, may have opened a new field.

The Amelia field, near Beaumont, Tex., proved to be at least a two-sand pool when an extension test, a failure in the Frio sand, in which the field was opened, was plugged back to the Marginulina and started producing 75 barrels of distillate daily. A new producing sand was found in the shallow Cooke County, Texas, field, starting lively drilling operation. Production of 20 barrels an hour from the Paluxy sand, upper member of the Trinity series, in an uncompleted test in the Talco area of Titus County, Texas, points to a new and important field. Discovery of a 6,000,000-foot gas production 75 feet below a sulfur water stratum in a Gaines County, Texas, wildcat, gives that county a chance to get into the producing column.

Production 2,816,817

Increase 43,752

A deep test in Love County, Southern Oklahoma, drilled to about 6,955 feet, stood with 1,400 feet of fluid, mostly oil, in the hole, and received an acid treatment. Love County is outside the producing area.

An uncompleted well in Ellis County, Kansas, was estimated to be good for 3,000 to 5,000 barrels a day. Two prospective pools were uncovered in Russell County. Production in the Rodessa field in North Louisiana was being kept below the allowable, and operations were slowing down.

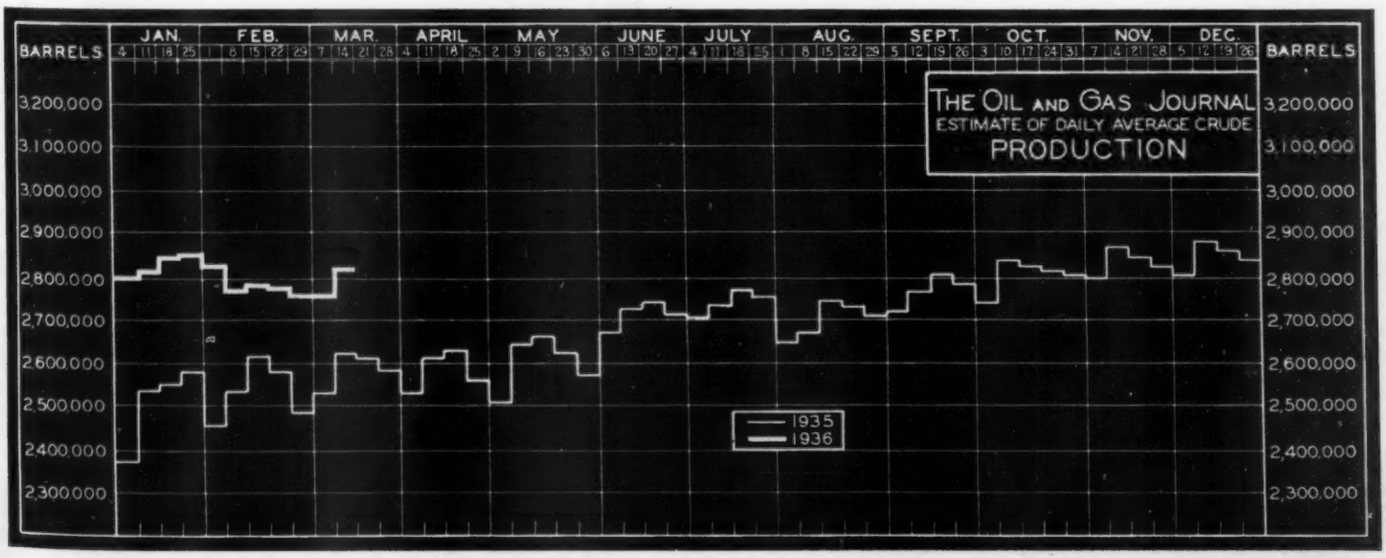
Daily Average Production for Week

	March 14 1936	March 7 1936	March 16 1935
Oklahoma City	120,775	107,500	162,900
Seminole-St. Louis	97,550	91,125	99,825
Remainder of State	296,450	274,575	248,084
Total Oklahoma	514,775	473,200	510,809
East Texas	449,804	447,450	458,644
West Texas	173,898	172,847	145,898
North Central Texas	81,550	81,550	90,257
Texas Panhandle	59,147	67,197	60,562
East Central Texas	50,603	48,207	52,387
Gulf Coast—Texas	227,752	227,852	179,169
Southwest Texas	73,348	71,548	59,730
Total State of Texas	1,116,102	1,116,651	1,046,647
North Louisiana	57,150	56,895	23,175
Gulf Coast—Louisiana	135,600	134,249	97,180
Total Louisiana	192,750	191,144	120,355
Santa Fe Springs	43,300	43,750	39,750
Long Beach	69,000	69,250	69,750
Mountain View	27,250	26,900	14,100
Kettleman Hills	77,250	75,750	61,100
Remainder of State	349,200	353,100	345,800
Total California	566,000	568,750	530,500
Kansas	141,150	141,100	149,741
Arkansas	29,765	29,820	30,795
Eastern Fields	107,500	108,000	104,750
Michigan	34,385	36,500	38,867
Rocky Mountain area	114,390	107,900	94,320
Total United States	2,816,817	2,773,065	2,624,784

Crude Oil Stocks in U. S.

(BUREAU OF MINES ESTIMATES)

Week ending March 7, 1936	310,105,000
Week ending February 29, 1936	309,444,000
Week ending March 9, 1935	339,000,000



SPARKS FROM THE NEWS

Lull?

Rodessa completions quietly passed century mark last week with production well in hand. What will happen when seven pipe lines serve the field?

Popoff

We can well do without half-cocked statements and false accusations such as one that Rodessa is supplying 15,000 bbls. of hot oil daily.

Viewpoint

A presidential candidate worries about monopoly within the oil business. The industry worries about what may come from without.

Preview

Following veritable Hollywood build-up, Peveto and others brought in a real oil well in Titus County.

Relief

Gasoline consumption during January makes pleasant reading especially in view of bad weather encountered. Banner consumption year is indicated.

Greeting

Increasing demand and draft on reserves are making geologists welcome again in oil offices.

Modernization

Refinery reconstruction programs abound. Bright outlook for 1936!

Triumph

Interstate Compact Commission continues to gain in favor, prestige and results. More memberships are earnestly sought, very particularly those of California and Louisiana.

Contrast

All commodity price dropped to 79.7, lowest since August. And petroleum products rose to 54.4!

Ferrets

Oil industry is distrustful and apprehensive during these days of new tax hunting in Washington. Result of sad experience.

Heat

Government reports 39 per cent more oil burners sold in 1935. No news to furnace oil salesmen who worked 24-hour schedules January and February.

Appreciation

Michigan is to exempt drilling machinery and equipment from the 3 per cent sales tax. Michigan realizes what the oil industry means to it.

Insurance

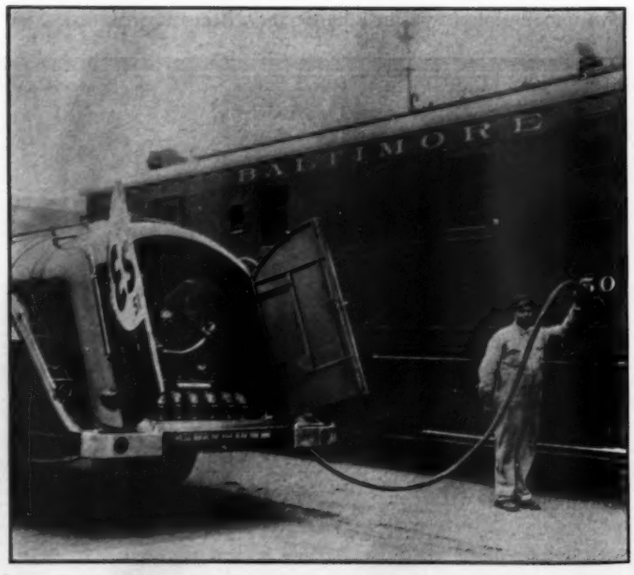
It is said that major company has completed arrangements to take over extensive properties in Rodessa area of well known independent.

Raw

Mexican business men protest administration is forcing them to turn over their business to labor or the government. And they don't call it a new deal.

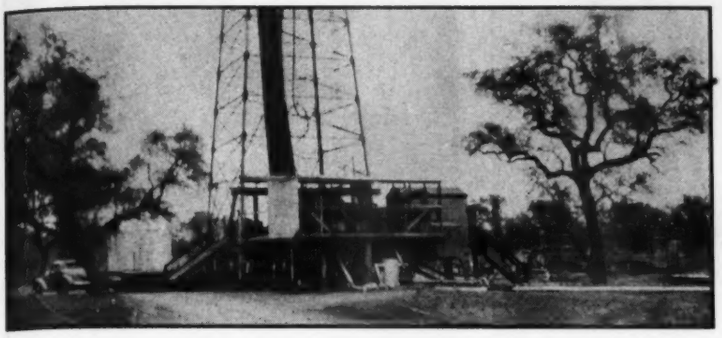
Visions

Amerada's recent sensational discovery in Frio County, Texas, brings back the Austin chalk for real working over. Southwest Texas is a-twitter.



Servicing a diesel powered locomotive

Ten Wells Are Producing From 3 Horizons in Pearsall Field

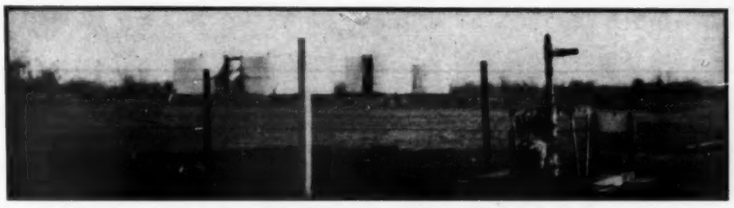


Amerada Petroleum Corp. No. 5 Halff and Oppenheimer, Pearsall field.

By L. G. E. BIGNELL

Since the first of this year several wells have been completed by Amerada Petroleum Corp. and Rycade Oil Corp. in what is known as the Pearsall field in Frio County, Texas, that have attracted more than usual attention. These wells are producing from the Navarro sand, Austin chalk and Buda lime and are so scattered as to test an area more than 7½ miles long for oil and more than 11½ miles long if showings of gas and oil are considered. The two companies acquired more than 85,000 acres along this major structure which extends across one country and into another, and it is to be remembered counties in West Texas cover as much land area as some of the smaller states in the East.

Back in 1931 the Amerada Petroleum Corp. became interested in this area and commenced to accumulate acreage and make a series of spudder tests for the purpose of mapping structure. More than 14 of these wells were drilled in the area east of the Leona River in Frio County and they varied in depth from 300 to as deep as 1,400 feet. This work was followed by geophysical survey of the area and from these data the geological department mapped the general structure now being drilled and recommended the purchase of the acreage.



Discovery well of the Pearsall field, Frio County, Texas

This oil has apparently accumulated in several formations located upon this major structural feature because the wells have been completed in Navarro sand, Austin chalk and in the Buda lime and showings have been had in other formations in some of the test wells which have been drilled to depth below the Buda lime, then plugged back.

The first test wells in this area were drilled outside of the Amerada-Rycade block by the Midland Oil Co. and at total depths of 4,005 and 4,069 feet were reported dry and abandoned.

After drilling their No. 2 Halff-Oppenheimer well to a total depth of 10,050 feet and testing the lower Trinity formation the Amerada Petroleum Corp. plugged back and shot this well through the casing to bring in a producer from the Navarro sand found at 3,920 feet. When first completed in this pay horizon the well yielded only a small amount of oil and gas but repair work on the hole has since brought the daily production of oil up to about 100 bbls. with about 5,000,000 feet of gas. This oil has about 25 degrees gravity. Water produced when the casing was first shot has been successfully plugged off.

In drilling the first wells in this area it was usual practice to set the string of surface casing at about 1,400 feet to shut off water but later practice has been to set about 250 feet of either 10 or 13-inch regular casing. If the 13-inch string is set the hole drilled below this point is 11¼-inch diameter and is carried to the top of the formation to be tested where a string of 9-inch casing is set and cemented.

Later practice has been to use the smaller diameter surface string and then drill a 9½-inch hole to the top of the Navarro sand, Austin chalk or to the Buda lime depending upon which formation is to be produced, and then set a flow string of 7-inch casing and cement.

In making the deep test on Amerada-Rycade No. 2 Halff-Oppenheimer well a string of 9-inch casing was set at 4,952 feet and cemented. An 8⅝-inch hole was drilled out of this casing and 7-inch liner run to the top of the Edward lime found at about 5,990 feet and the hole then drilled for a way below the bottom of the liner. It was found this procedure was not necessary so the 7-inch liner was pulled and the hole reamed and then drilled to the total depth of 10,050 feet without casing below the 9-inch string. Because the lower formations were nonproductive the hole was plugged back to the Navarro sand at 3,860 feet where the casing was shot and production secured.

In all 12 wells have been completed, four finding the pay in a section of the Navarro sand at about 3,850 feet; one in the Buda lime at 5,883 feet and four getting the pay in the Austin chalk found at about 5,400 feet. Of the other three wells one is dry and one is a gasser in the Edwards lime while the third well is now being redrilled to the Austin chalk after being reported dry in the Navarro sand.

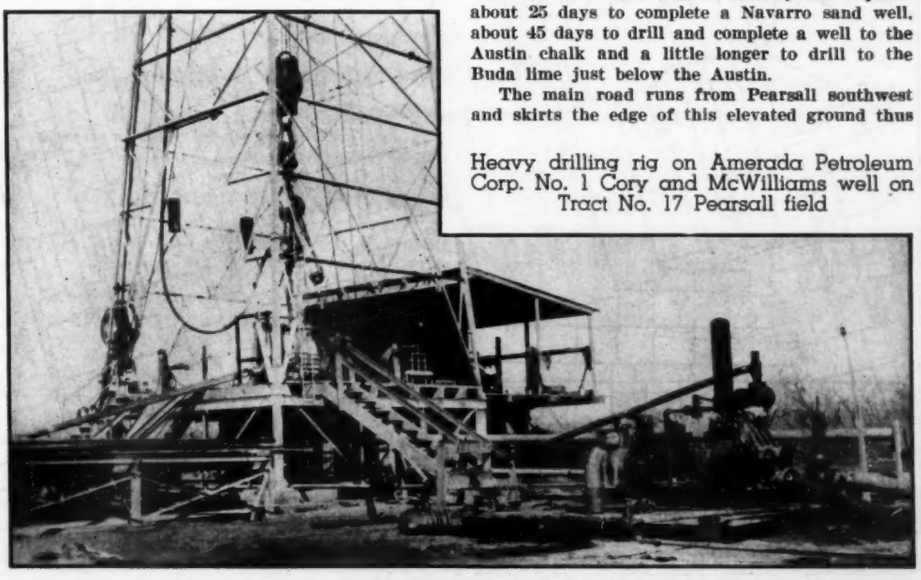
The exact section of the Navarro sand productive in this area is not definitely known nor is the exact character of the Austin chalk production determined. It does not appear to be crevice oil in the Austin chalk for the extent of the oil bearing zone is too large to admit of that as a reasonable explanation but the exact explanation of how the oil has accumulated in this formation is not as yet given.

The area now opened by the oil wells is approximately 7½ miles from the eastern end of the block of acreage toward the southwest, and if the Doering gas well is included as being on this same structure the total developed length is about 14½ miles.

The field is served by a 6-inch pipe line about 11½ miles long extending from Amerada-Rycade No. 1 Cory-McWilliams east of No. 1 Smith and then northeast to the Halff-Oppenheimer lease. From there the line runs southeast to the town of Melon on the I. G. N. Railroad where two 55,000-bbl. steel tanks are now being erected to handle this oil. The main trunk line of the Humble Pipe Line Co. between West Texas and Ingleside terminal near Corpus Christi passes within about 36 miles of this property, and may form an outlet.

The drilling so far has all been done with steam driven rotary outfits with the exception of one diesel powered electric generating unit now in use at one of the wells. The four steam rigs secure their water from wells drilled to a good water sand found at about 1,900 feet or from the river while fuel has been either oil secured from some of the wells or gas produced by Amerada-Rycade No. 1 Doering. The digging is all hard and rock bits are used almost entirely. It requires about 25 days to complete a Navarro sand well, about 45 days to drill and complete a well to the Austin chalk and a little longer to drill to the Buda lime just below the Austin.

The main road runs from Pearsall southwest and skirts the edge of this elevated ground thus



Heavy drilling rig on Amerada Petroleum Corp. No. 1 Cory and McWilliams well on Tract No. 17 Pearsall field

LOG OF WELLS IN PEARSALL FIELD, FRIO COUNTY, TEXAS, IN ORDER OF DRILLING

Formation—surface elevation, 540-600 feet—	(1) Navarro (feet)	(2) Dry (feet)	(3) Navarro (feet)	(4) Navarro (feet)	(5) Navarro (feet)	(6) Austin (feet)	(7) Buda (feet)	(8) Deepening (feet)	(9) Gas (feet)	(10) Austin (feet)	(11) Austin (feet)	(12) Austin (feet)
TERTIARY:												
Carrizo	1,190	1,370	1,280	1,250	1,280	1,200	1,320	.....	1,340	1,232	1,380	1,327
Wilcox	1,436	1,580	1,500	1,463	1,520	1,360	1,485	1,505	1,540	1,432	.....	1,488
Midway	2,580	2,713	2,620	2,613	2,610	2,526	2,650	2,585	2,620	2,610	2,540	2,690
Marine Midway	2,720	.....	.....	.....	.....	.....	.....	2,725	.....	.....	.....	.....
UPPER CRETACEOUS:												
Navarro	3,090	3,255	3,120	3,110	3,110	3,020	3,150	3,110	3,180	3,170	3,060	3,190
Lower Navarro	3,850	4,067	3,860	3,860	3,870	3,900	3,970	3,957	4,045	4,040	3,900	4,020
Taylor	.....	5,060	4,850	.....	.....	.....	4,990	.....	5,082	5,420	5,262	5,024
Austin	.....	5,435	5,206	.....	.....	5,272	5,340	.....	5,470	5,490	.....	5,394
Eagle Ford	.....	5,889	5,625	.....	.....	.....	5,710	.....	.....	.....	.....	.....
Buda lime	.....	5,990	5,712	.....	.....	.....	5,883	.....	6,106	.....	.....	.....
LOWER CRETACEOUS:												
Del Rio	.....	6,092	5,810	.....	.....	.....	5,970	.....	6,216	.....	.....	.....
Georgetown	.....	6,195	5,891	.....	.....	.....	6,087	.....	6,315	.....	.....	.....
Edwards	.....	6,302	5,990	.....	.....	.....	6,186	.....	6,442	.....	.....	.....
Glen Rose	.....	.....	6,791	.....	.....	.....	.....	.....	.....	.....	.....	.....
Trinity	.....	.....	9,770	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total depth	3,921	6,312	10,050	3,936	3,945	5,655	6,252	4,370	6,507	5,569	5,465	5,467

(1) Amerada-Rycade No. 1 Davies, Navarro sand well, top sand 3,913 feet, total depth 3,921 feet, 33 bbls. per hour on gas lift, 25 bbls. per hour natural, completed April 19, 1935.

(2) Amerada-Rycade No. 1 Halff-Oppenheimer, total depth 6,312 feet, dry and abandoned.

(3) Amerada-Rycade No. 2 Halff-Oppenheimer, total depth 10,050 feet, plugged back to 3,915 feet, top Navarro sand 3,920 feet, completed for small oil and gas well, January 6, 1935. Well later repaired and now making 100 bbls. oil daily, 5,000,000 feet gas.

(4) Amerada-Rycade No. 3 Halff-Oppenheimer, top Navarro sand 3,916 feet, total depth 3,936 feet, initial production 270 bbls. per day. Water broke in; plugged back and worked over. Initial production 140 bbls. per day, one-half inch choke, 25 degrees gravity oil. Completed February 9, 1935.

(5) Amerada-Rycade No. 4 Halff-Oppenheimer, top Navarro sand 3,921 feet, total depth 3,945 feet, made oil and water, plugged back to 3,921 feet, initial production 5 bbls. per hour, one-quarter inch choke, 25 degrees gravity. Completed May 25, 1935.

(6) Amerada-Rycade No. 1 Michael, completed January 3, 1936, total depth 5,655 feet in Austin, made 3,086 bbls. in 28 hours through 1-inch choke, gravity 28.

(7) Amerada-Rycade No. 1 Smith, completed September 13, 1935, total depth 6,232 feet, showing of water and plugged back to 5,920 feet, made Buda lime producer, 79 bbls. per hour, 1-inch choke, 39.1 gravity (Navarro sand 4,014 feet).

(8) Amerada-Rycade No. 1 Kothman, completed August 1, 1935, total depth 4,370 feet, top Navarro 3,957 feet, dry and abandoned. Now drilling to Austin chalk.

(9) Amerada-Rycade No. 1 Doering, total depth 6,507 feet, Edwards lime gasser used for fuel, initial production 4,000,000 feet, 15⅛ bbls. sulfur water and one-half barrel oil daily, plugged back to 6,459 feet.

(10) Amerada-Rycade No. 1 Cory & McWilliams, top Navarro sand 4,082 feet, top pay in Austin chalk 5,490 feet, total depth 5,569 feet, treated with 3,000 gallons acid and no improvement. Cleaned out with portable cable tool machine, then shot with 130 quarts and made 300 bbls. per hour. Allowable after potential test, 269 bbls. per hour, 8,000,000 feet gas. Austin chalk well.

(11) Amerada-Rycade No. 5 Halff-Oppenheimer, finished February 28, 1936, acidized March 5, 1936, total depth 5,465 feet in Austin chalk, made 336 bbls. in 24 hours; after acidizing made 850 bbls. per day.

(12) Amerada-Rycade No. 6 Halff-Oppenheimer, completed March 4, 1936, total depth 5,467 feet in chalk, flowed 1,316 bbls. in 80 minutes through open tubing and casing. On proration test through 2⅛-inch tubing and 1-inch choke made 208 bbls. per hour. Top Navarro sand 4,065 feet.

affording a good entrance into the property. This road beyond Pearsall is not paved but is graded and coated with oil and is serviceable the year round. The I. G. N. Railroad passes through the town of Pearsall and has long been the station serving the area.

During the period of the World War, or from 1914 to about 1921 the farmers of this region enjoyed great prosperity because of the demand for their onion and spinach crops. It is stated these farmers actually were paid millions of dollars for these vegetables during that period and believed their prosperity was assured for all time made no special effort to retain their market. The result has been comparative poverty now that other sections of Texas and the South are producing these crops and competing but while these farmers in Frio County enjoyed the monopoly on the commodities they lived in style, many moving into high priced apartments and hotel suites and buying expensive cars and other luxuries.

To reach the drilling sites it has been necessary for the oil companies to build their own roads from the main highway and the principal work to be done in road construction consists of cutting away and grubbing up the mesquite brush. After this thorny bush is out of the way the actual grading of the roadbed is not difficult.

In drilling these wells care is exercised in selecting mud fluids and keeping foreign material from entering into the formations. In some wells it has been found that the production was materially lowered after making a good drill stem test because the mud and water had entered the formation. The wells have been acidized, without much improvement, and have also been shot with nitroglycerin which has given better results in some instances. It is reported the formation pressure tested by subsurface pressure gauges opposite the Austin chalk is about 2,200 pounds per square inch. Navarro sand above and Buda lime below the Austin chalk have corresponding pressures.

Plat of Amerada-Rycade acreage near Pearsall, Frio County, Texas, showing locations of wells

W. B. WILSON
Vice Chair'n Arrangement Committee A. A. P. G. Meeting

FRANK R. CLARK
Chairman General Committee A. A. P. G. Meeting

IRA H. CRAM
Vice Chairman Program Committee A. A. P. G. Meeting

The Price of Crude Oil in Perspective

By JOSEPH E. POGUE
Consulting Engineer, New York

We are so accustomed to dealing with the price of crude oil in its variations from place to place and over short periods of time that its relative and long-term movements are apt to be overlooked. It may be of interest, therefore, to view in perspective the broad sweep of the crude oil price structure since the inception of the American petroleum industry. For this purpose it is necessary to eliminate detail and condense the data into a single average, such as the weighted average price of crude petroleum in the United States published by the U. S. Bureau of Mines. This series by years from 1859 to 1935 is given in Table 1.

The Price Record

Figure 1 shows by years from 1860 to 1935 the weighted average price of crude oil in the United States compared with the price of 30 basic commodities (Warren-Pearson Index). Both series are expressed as index numbers, with the five-year prewar period of 1910-1914 taken as a base of 100. The actual price corresponding to the crude oil index is also entered on the scale to the right, so that the price in dollars per barrel can be interpolated. A study of this chart reveals two important features: (a) The price of crude oil tends to conform in its broad movement with the prices of other basic commodities; and (b) the price history of crude petroleum has been written in five chapters, each influenced by a dominant development in the industry.

Relation to Basic Commodity Index

The correlation between the price of crude oil and the price of 30 basic commodities is general rather than specific. The crude oil curve has much greater amplitude of movement than the commodity curve, but this is due in part to the comparison of a single average with a composite average in which the individual aberrations tend to be ironed out. Also for short periods of a year or more the two curves not infrequently diverge. Nevertheless, the exhibit indicates that, broadly speaking, the price of crude petroleum is strongly influenced by the same underlying economic forces that affect other commodities. This generalization is important because we are prone to look upon the price of crude oil as an isolated phenomenon having only a remote connection with the general level of prices. It may be observed that each time the crude oil index rose above the commodity index, the lapse of time witnessed its return to the general level. Thus, while the price of crude oil may be determined for short periods by conditions peculiar to the oil business, it is responsive in the long run to those forces that dominate our economy. Circumstances within the business affect primarily the supply side of the supply-demand equation, while general conditions control the demand side of the equation.

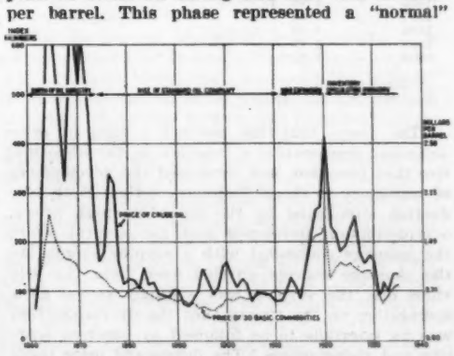
A.A.P.G.—The price of crude is reviewed in perspective from the inception of the industry by a comparison between the weighted average price of 30 basic commodities. This paper was read at the twenty-first annual meeting in Tulsa, March 19.

A close study of Figure 1 will reveal five important phases of the price history of crude petroleum, which may be tabulated as follows:

Phase	Period	Length (years)	Price ($ per bbl.) Average	Price ($ per bbl.) Range	Dominant feature
1	1859-1877	19	4.28	0.49-16.00	Birth of industry
2	1878-1915	38	0.81	0.51- 1.19	Rise of Standard Oil Co.
3	1916-1920	5	1.94	1.10- 3.07	War expansion
4	1921-1926	6	1.61	1.34- 1.88	Inventory speculation
5	1927-1935	9	1.01	0.65- 1.30	Proration

The earliest period, 19 years in length, covers the formative stage of the petroleum industry and was marked by extremes of price fluctuations. In the forepart of this cycle, prices varied up to several hundred per cent from one year to the next, but a tendency toward stabilization at lower levels appeared as the industry progressed toward an established status. This period corresponds with the commodity price inflation brought about by the Civil War and with the deflation following that disturbance.

The second phase of oil prices made its appearance around the three-quarter mark of the past century and lasted until the outbreak of the World War. This period was 38 years in length and was characterized by considerable price stability, relatively low average levels, and, broadly viewed, a horizontal trend. The weighted average price of crude oil during this time was 81 cents per barrel. This phase represented a "normal" period lying between the inflation of prices accompanying the Civil War and the price inflation generated by the World War. During this period, a significant feature of the petroleum industry was the rise of the Standard Oil Co. to a dominant



Weighted average price of crude oil compared with 30 basic commodities by years 1860-1935. (1910-1914 = 100)

position and its dissolution by court decree in 1911. The structure of the industry during this entire term was one on nonintegration as between crude oil production, on the one hand, and the transportation-refining-marketing activities, on the other. There was thus a discontinuity between the function of producing crude oil and the rest of the industry. This era largely antedated the important use of gasoline as motor fuel.

The third price cycle under review was a short one, only five years in length, extending from 1916 to 1920. It coincided with the rise of war demands, credit financing, and inflation of commodity prices that accompanied and followed the World War. The weighted average price of crude oil rose from 64 cents a barrel in 1915 to $3.07 per barrel in 1920. This term was also marked by the development of considerable integration between crude oil production and the other departments of the industry. The tendency of demand to run ahead of supply gave rise to the "shortage concept" which has influenced the industry at intervals ever since. The profits generated by the rise in prices brought the industry for the first time into the money markets for new capital on a large scale and set in motion an inflow of new capital that was responsible for much of the overproduction that ensued later on. A renewed inspection of Figure 1 will emphasize the wholly abnormal character of the oil price structure during this inflation phase.

TABLE 1—WEIGHTED AVERAGE PRICE OF CRUDE PETROLEUM IN THE UNITED STATES BY YEARS, 1859-1935. DATA FROM U. S. BUREAU OF MINES

(In dollars per barrel)

	1859	16.00	
	1860	9.59	
1861	0.49	1901	0.96
1862	1.05	1902	0.80
1863	3.15	1903	0.94
1864	8.06	1904	0.86
1865	6.59	1905	0.62
1866	3.74	1906	0.73
1867	2.41	1907	0.72
1868	3.62	1908	0.72
1869	5.64	1909	0.70
1870	3.86	1910	0.61
1871	4.34	1911	0.61
1872	3.64	1912	0.74
1873	1.83	1913	0.95
1874	1.17	1914	0.81
1875	1.35	1915	0.64
1876	2.52	1916	1.10
1877	2.38	1917	1.56
1878	1.17	1918	1.98
1879	0.86	1919	2.01
1880	0.94	1920	3.07
1881	0.92	1921	1.73
1882	0.78	1922	1.61
1883	1.10	1923	1.34
1884	0.85	1924	1.43
1885	0.88	1925	1.68
1886	0.71	1926	1.88
1887	0.67	1927	1.30
1888	0.65	1928	1.17
1889	0.77	1929	1.27
1890	0.77	1930	1.19
1891	0.56	1931	0.65
1892	0.51	1932	0.87
1893	0.60	1933	0.67
1894	0.72	1934	1.00
1895	1.09	1935	*0.98
1896	0.96		
1897	0.68		
1898	0.80		
1899	1.13		
1900	1.19		

*Estimated.

The years 1921-1926 covered a time of price deflation representing a reaction to the abnormal rise that preceded, and witnessed the development of resistance to the deflationary reflex. With production stimulated by the preceding high prices, overproduction developed and for several years the industry contended with a surplus supply. As the shortage concept carried over from the previous era, the surplus was willingly stored as a speculation on the theory that the overproduction was an interlude to be followed by renewed scarcity and rising prices. The downward price tendency was accordingly arrested for a time and even temporarily reversed, but at the expense of a vast accumulation of crude oil in storage. The oil price structure for a term of five or six years was accordingly influenced by inventory speculation, a procedure that inflated demand to the extent of the quantity stored but at the same time set up a claim on future demand that subsequently had to be liquidated.

The fifth phase in the development of the crude oil price structure was the logical outgrowth of the third and fourth cycles previously reviewed. The stimulus of war prices, working through the responsive medium of advancing technology, created a momentum that the spectacular rise in gasoline consumption was unable to absorb; a momentum too great, also, to be offset by the expedient of inventory accumulation. Proration, accordingly, evolved as an instrumentality for holding the unwanted oil in underground storage; but this device was unable to halt the fixation of capital in the new reserves and hence an expanding crude oil "potential" was built up which eventually, when demand turned downward during the depression, led to a return of crude oil prices to the prewar level. For the three-year period, 1931-1933, the weighted average price of crude was 73 cents per barrel, or slightly below the prewar average. Then came the petroleum code and the stabilization of crude oil prices at a dollar base, which continued, with some local interruption, into January of 1936, when the base price (36 degrees Mid-Continent crude) was advanced 10 cents per barrel.

The period of proration is complicated by its position covering the later phases of the credit inflation of the twenties, the drastic deflation resulting therefrom, and the early stages of recovery starting in 1932. These dominating phases of our economy were important influences in the effect exercised by proration upon crude oil prices, modifying the stabilizing results that proration was expected to bring about. In the latest phase, the sharp rise in oil demands that has latterly accomplished the recovery movement has played a dominant role in strengthening the oil price structure.

This brief review of the price history of crude petroleum and the main external forces that have affected it would not be complete without calling attention to the fact that prices respond naturally to no force unless it alters either supply or demand. Price, however, is more than a response to supply and demand; it, in turn, influences supply and demand. Price, therefore, is both a cause and an effect; and the causal price role is often overlooked. In the presence of competition, price in its causal role, exercises four functions:

(a) Price tends to equate supply and demand.

(b) Price tends to integrate supply and demand, adjusting the component parts of one to the other.

(c) Price tends to regulate the inflow and outflow of capital, the fundamental control of supply.

(d) Price tends to repel or attract the fund of general purchasing power, the fundamental control of demand.

Under proration, price is relieved of the first mentioned function to a large extent, and partly so in respect to the second. But the effect of price upon capital movements and purchasing power is not altered by proration. Therefore, under proration, the innate price response to an artificial balance between supply and demand is limited and whenever price is forced above its critical point the result is valorization which is disruptive of equilibrium and cannot be sustained. The future of crude oil prices, with proration operative, will probably depend to a considerable degree upon the position of the critical level.

Petroleum Industry Is Interested in Legislation at Washington

By HUGH D. MALLON

WASHINGTON, D. C., Mar. 16.—Concern over the future of corporation taxes is being evidenced by corporation leaders and fiscal experts who are of the opinion that, even though present corporate income, capital stocks and other levies are repealed to ease the path of the proposed corporation surplus tax, there is no certainty that the same taxes, or their substitutes, may not be renewed at the next session. It is the opinion that the administration will almost be forced into reenacting the repealed measures in the near future to finance the cost of present and future huge outlays being made and contemplated. The tax on corporation capital stock was to be for only one year, although it has been in effect since 1934.

Meantime estimates indicate the surplus tax would not bring the return claimed but would saddle on the public a much higher individual income tax rate.

With executive sessions of the committee considering the Hayden-Cartwright bill scheduled this week, attempts are being made to amend the bills to clear up ambiguity in the provision which allows states not able, through their gasoline and lubricating oil taxes, to pay their proportionate share of the cost of laying roads with federal assistance, to receive such aid and to make mandatory the use of domestically produced, as well as processed, asphalt wherever practicable.

The gasoline and lubricating oil tax provision is being inserted at the insistence of Senator Robinson of Arkansas. An amendment, proposed by oil representatives, would safeguard the industry from diversion of gasoline taxes and protect the industry from increases in the state and federal gasoline taxes.

The amendment to make mandatory the use of domestically produced asphalt in all roads built with federal aid has been sponsored by Russell B. Brown of the Independent Petroleum Association of America. It is not specific as to asphalt, but provides that all contracts shall provide for the use only of domestically produced and processed articles. At present the Bureau of Public Roads is allowing foreign produced asphalt processed in this country to be used.

The Wheeler-Rayburn bill broadening the powers of the Federal Trade Commission has been reported to the senate by the committee on interstate commerce. If this bill is passed the government will be able to go into any business house, or office and demand records, confidential or not, be turned over for examination. The only information the commission would be required to keep confidential would be "trade secrets and the names of customers."

Another amendment to the antitrust laws now before the Senate Interstate Commerce Committee is a bill to "protect public against combinations in restraint of trade, to prevent unnecessary and wasteful cross-hauling of commodities, to restore and preserve purchasing power, and to aid in the prevention of the recurrence of economic stringency." This bill seeks to make it illegal for maintenance of uniform delivered prices, thereby "discriminating among purchasers by bearing substantially greater expense of transportation charges on sales to some customers than on sales to other customers."

The bill provides that it shall be unlawful for any person to add to the shipping point price of any commodity a charge for delivery to the destination other than the actual cost of delivery through such agency as the purchaser may specify.

While this bill is aimed directly at the steel and cement industries its provisions would seriously hamper the oil industry in maintaining prices at service stations, regardless of whether the freight or carriage charges were figured into the retail cost. Hearings are now being held in the senate committee.

Union Oil Co. No. 1 Lillis-Welsh, Fresno County, Calif., broke deep drilling record by reaching 10,585 feet April, 1933; lost bit at 10,944 feet; taken over by Union, April 1934, and is now cleaning out at 11,127 feet. Unusual photograph of drilling crew

Compact Needs Support of Industry and Public

OKLAHOMA CITY, Okla., Mar. 16.—Federal regulation of the oil industry was held up before the quarterly meeting of the Interstate Oil Compact Commission here, when Gov. E. W. Marland of Oklahoma, chairman of the commission, warned "it is a mistake to think that the end of the federal petroleum code was the end of federal interest in the oil business or in the oil reserves on which our national routine is dependent."

Col. E. O. Thompson, chairman of the Texas Railroad Commission and a vice-chairman of the compact commission, issued a statement in which he asserted "the compact provides for meetings of representatives of sovereign states to discuss common problems in prevention of physical waste," and warned "we'll never get in trouble if we stay within the treaty."

Governor Marland observed that: "The federal government ought to supplement the state's activities by performing three functions: First, preventing interstate movement of hot oil; second, controlling imports; and third, making findings of fact and forecasts as to supply and demand."

The compact itself, he said, "is necessarily a compromise" because of the diverse interests of the sovereign states.

"It expires by its own terms in September, 1937, and, if renewed, a new compact must be negotiated then," he continued. "It is not as complete an instrument as that which the Federal Oil Conservation Board proposed in 1932, but it is the best engine we have available at the moment for use in the cause of oil conservation.

"It ought to be apparent to everyone that this kind of a voluntary arrangement among half a dozen sovereign states, with nothing compulsory about it, is going to do just as much or just as little for the cause of conservation as the enlightened public opinion in those states and in the petroleum industry as a whole demands.

"Three things can happen to the interstate compact:

"First, now that the fear of federal control has subsided, the industry may lose interest in the compact and let it fall to pieces. If that happens, it will be a tragedy for the industry itself, a tragedy for the principles of local self-government, and a tragedy to the consumers who must depend on these oil-producing states for a long-continued supply of oil at reasonable prices.

"Second, the compact system can take a strong root, receive the vigorous support of the industry and of enlightened conservationists, and do many of the things for protection of our irreplaceable reserves that the advocates of federal control have insisted were their own objectives, and yet accomplish those purposes in a constitutional way without infringing local powers of our people. If the compact is to succeed in that way, the states have got to be kept actively interested in it.

"Third, the compact may be overshadowed by an unexpected resurgence of the demand for federal regulation. The public has been indifferent to conservation of oil and gas because the price of gasoline has never reached a resistance level. But if the compact fails, if our petroleum reserves are selfishly used, and if the pocket nerve of the consuming public is suddenly pinched, the industry may encounter demands for regulation of a character that will make preceding attempts seem mild."

The movement for greater federal control of the oil business has not run its course, the governor asserted. Again he warned:

"Those who think that the federal government's power to regulate oil production under the war powers cannot be effectively exercised in peace time may overlook the possibility that future neutrality legislation might form the basis for regulations carrying the federal government's supervision of the oil business deeper than it has yet gone.

"There is going to be stronger agitation for federal regulation of pipe lines, particularly gas lines.

"The federal government has a legitimate function in studying the demand for petroleum and its products. There is a feeling that the Bureau of Mines has functioned well and its work ought to be strengthened.

"In the control of imports and exports, it is conceded that the federal government is capable of functioning where the states and the industry are not. The method of adjusting our imports and protecting American investments in foreign fields is not yet entirely satisfactory, and little has been attempted toward governmental agreements for protection of our export trade.

"There is wide recognition of the necessity for federal control of interstate shipments of hot oil, on a permanent basis. Whether one believes federal activities ought to expand along any of these many lines or not, it is a mistake to think the end of the federal petroleum code was the end of federal interest in the oil business or in the oil reserves on which our national routine is dependent."

The governor's address set the stage for a report on conservation by Homer Hoch, chairman of the Kansas Conservation Commission and chairman of the compact commission's conservation committee. Chairman Hoch had placed in the record a voluminous, detailed report of a subcommittee headed by Marvin Lee, technical adviser to the Kansas Corporation Commission. Other members of the subcommittee were Dr. E. H. Wells, state geologist of New Mexico, and C. C. Brown, of the

Oklahoma Tax Commission, a technical adviser to Governor Marland.

Mr. Hoch said the subcommittee report revealed that conservation legislation is needed in most, if not all, of the oil-producing states, but he warned definite limitations on the industry should not be fixed by the legislatures, but the regulatory agencies of the states should be given authority to make wide use of their powers.

"Legislative committees should carefully study the results of previously enacted and proposed laws in other states and benefit from the trial and error of attempted or existing legislative action," Mr. Hoch continued. "Mistakes of the past 75 years should be considered and improvement made wherever possible.

"Oil and gas fields are not restricted by state boundaries, but conservation has been restricted and hampered by failure to have more uniform state laws and regulations by regulatory bodies. Legislatures should authorize their state regulatory agency to cooperate with similar agencies of adjoining states for conservation purposes in all fields crossing state lines.

"It should be both the duty and privilege of those in the industry to ascertain and present facts to state legislative bodies; failing to do this the industry should not criticise anyone but itself."

Reservoir Energy

Conservation of reservoir energy is a proper subject for legislative action, Mr. Hoch said. The energy should be utilized to produce oil or gas without unnecessary surface or underground waste, and proper use of it would retard water encroachment in fields and increase the ultimate recovery of oil, he said.

Likewise, proper well spacing would tend to prevent physical waste, to reduce development and operating costs and to increase the ultimate oil recovery. In ordering well spacing the state regulatory agencies should not be hampered by rigid laws, he said, because of local conditions.

In the sections of the report devoted to drilling control and regulation, the committee asserted no legislation should be enacted to control or restrict exploratory or wildcat drilling. Drilling in probable extensions of known fields should be subject to any laws and regulations pertaining to such areas. Drilling of wells, however, are subject to laws and rules which would aid conservation.

"The operation of a pool as a unit under one management has economic advantages," Mr. Hoch continued. "It results in minimum development and production costs. Maximum conservation of oil, gas and reservoir energy are possible, as well as large ultimate recovery.

"Unit operation also has its disadvantages. If completely developed, the determination of the boundaries of the pool is impossible. An appraisal of the producing value of the various holdings at the time of unitization is difficult or impossible. It is impracticable to radically alter or revoke such a plan when once put into operation.

"Unit operation should be permitted with the approval and under supervision of the existing regulatory agency when all the persons interested mutually agree upon the plan and period of operation."

The committee chairman recognized proration as necessary to prevent physical waste and maintain production within reasonable market demand, and pointed out that the method of proration is in accordance with the recommendations of the producers as well as in keeping with the laws.

Ratable taking goes hand in hand with proration, he said, showing such practice is necessary for the protection of the property rights of the various producers, landowners and royalty interests.

"Ratable taking for prevention of physical waste should be clearly and legally defined and the commission or regulatory bodies should not be required to allocate to all pools and wells on the same plan," he asserted.

The committee pointed out the complications in fields and said no attempt should be made for specific laws for determination of allowables, that "a uniform method for all the wells within a state may result in inequities and interfere with the best conservation practice."

All states should have legislation permitting the state regulatory agency to provide for repressuring with air, gas, water or other liquids, the report said.

Doctor Wells, in reporting for the committee on consumption, said he was a member of the committee going to Washington to study the Bureau of Mines method of determining market demand which was approved by the committee, and recommendation made that the compact commission aid the work by calling on all producers and refiners to file reports regularly and promptly on production and crude runs to stills.

This committee asked that the Bureau of Mines make a study of the gasoline content of crude in storage, and this was approved by the bureau, conditioned on an appropriation for the work. There now is a provision in the budget of the Department of Interior—approved by the senate—for $17,500 for continuance of the market demand forecasts, and $37,500 for making the crude oil survey.

The commission recessed and set the next meeting date as July 31, at Dallas, after receiving invitations from the Texas delegates and officials so the commission might attend the Texas Centennial Exposition.

Representing Texas were Col. E. O. Thompson, with Jack Blalock and Elwood Fouts; Kansas, Homer Hoch, with Marvin Lee; New Mexico, Dr. E. H. Wells; Illinois, William Bell, and Oklahoma, Governor Marland, with Tom Anglin, W. J. Holloway and C. C. Brown. H. C. Bretschneider, representative of Colorado, was unable to attend.

Noncompacting states having observers at the conference included: California, J. R. Pemberton, state oil umpire; Indiana, V. E. Bolyard, operator from Indianapolis; Ohio, Windell Stephens, independent operator; Michigan, H. L. Hunt, secretary Michigan Oil Producers Association, and, Wyoming, Wilfred O'Leary, operator.

Regrets at being unable to attend came from Gov. James A. Noe of Louisiana, who wired: "I'm going to see that no hot oil is run in Louisiana. With the cooperation of the oil fraternity we are going to keep the price up. Everything is in fine shape and we are going to keep it that way."

W. R. Boyd, Jr., executive vice president of the American Petroleum Institute, and Charles F. Roeser, president of the Independent Petroleum Association of America, were observers, and each pledged support of his association to the compact commission.

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OBITUARY

ARCHIBALD WAYNE DINGMAN, a leading figure in Alberta's early oil and gas development., died at Calgary on March 7, aged 85. A native of Ontario, he was for 34 years a resident of the Canadian West, organizing the old Calgary Natural Gas Co. in 1904 and securing the first Calgary gas franchise. In 1912 he organized Calgary Petroleum Products Co., whose No. 1 Dingman opened the Turner Valley field, and started the Calgary oil boom. His company also built the first gasoline absorption plant to operate in Canada. After its merger in Royalite Oil Co. Mr. Dingman organized Highwood-Sarcee Oils, Ltd., of which he was president.

A. W. DINGMAN

EDWARD McCALL, active for many years in oil production in the Canadian fields, died at Petrolia recently, aged 79.

A. LEEBOVE, 60, father of Isaiah Leebove, president, Mammoth Petroleum Corp., operator in Central Michigan fields for several years, died last week at his home in Pittsburgh, Pa.

WILLIAM J. McEWEN died at Toronto recently, aged 69. He went to Timor in 1898 as a driller, and spent 34 years in the oil fields of the Far East, retiring in 1932.

WILLIAM McGINLEY, Los Angeles, Calif., president, McGinley Oil Corp., Fort Worth, Tex., was killed in an automobile accident near Carlsbad, N. Mex. E. E. Reiswig, 55, and Wayne Pointing, 30, both of Fort Worth, were injured. Mr. McGinley had been connected in the oil business in Fort Worth for 15 years. Born in Decatur, Ill., he moved to Chicago and later to Fort Worth.

Bureau of Mines Report

Crude Petroleum—The production of crude petroleum in January, 1936, totaled 88,820,000 bbls., a daily average of 2,865,200 bbls. This average is only slightly above the average of December, 1935, but is 13 per cent above the average of January, 1935.

All the major producing districts in Texas recorded a decline in output in January, with the result that the daily average for the state decreased from 1,094,100 bbls., in December to 1,066,400 bbls. in January. Production in California showed a slight increase above the high level of December. The daily average output at Kettleman Hills fell to below 100,000 bbls., but this was offset by gains in various other valley fields. Daily average production in Oklahoma increased 17,400 bbls. as production in the Oklahoma City field, quite generally regarded as being incapable of revival, rose to 143,000 bbls., the highest since last July. Louisiana's new record was 179,700 bbls. daily, of which Rodessa yielded 29,000 bbls. Production in New Mexico, 61,800 bbls., was also a new record.

Increased crude runs were reflected in the trend of crude-oil stocks, the withdrawal increasing from 927,000 in December to 1,550,000 bbls. in January. Total crude stocks as of January 31, 1936, were 313,081,000 bbls.

Refined Products—The unusual fuel-oil demand again influenced the yield of gasoline, which declined from 44.0 per cent in December, 1935, to 42.7 per cent in January.

The domestic demand for motor fuel, 32,553,000 bbls., although below that in December, was surprisingly high in view of the generally unfavorable weather experienced in January. Stocks of motor fuel increased materially, finished gasoline rising during the month from 50,647,000 bbls. to 55,776,000 bbls., unfinished gasoline from 6,046,000 bbls. to 6,837,000 bbls., and natural gasoline from 3,698,000 bbls. to 3,936,000 bbls. The total for finished and unfinished gasoline stocks on January 31, 1936 (62,613,000 bbls.) was about 2,000,000 bbls. above the economic objective as of that date. Although the increases in motor-fuel stocks in January exceeded expectations, apparently the heavy additions were the result of an abnormally high refinery activity rather than a material decline in refinery shipments.

According to the Bureau of Labor Statistics, the price index for petroleum products for January, 1936, was 54.4, compared with 52.8 in December, 1935, and 48.8 in January, 1935.

Michigan Refining Plants Building or Planned Add 15,000 Barrels Daily

PAUL A. ELLIOTT

MUSKEGON, Mich., Mar. 16.—New refinery construction in progress or projected in Michigan will add 15,000 bbls. of crude capacity in a state already equipped with more than double the refinery and pipe line capacity to handle present crude production.

The trend in Michigan today, however, is toward the erection of modern cracking plants evidenced by recent announcements of plans for three such units.

Thirteen plants with a daily crude capacity of about 40,000 bbls. are running a total of only 18,000 bbls. Three are shut down and 12 are either just completed, being completed or proposed.

More than $2,000,000 will be invested in the new plants if present plans are realized. Michigan corporations with an authorized capital of well over $3,000,000 have been formed or are in the process of organization to carry out these plans.

One of the major developments in Michigan scheduled to result in the installation of a modern cracking unit through a merger of the Acme and Century Refining companies at Alma will be brought about by Leonard Refineries, Inc., a new $750,000 corporation. J. W. Leonard, Jr., who opened the Crystal field a year ago, March 28, is heading the enterprise.

Another major construction project announced by Old Dutch Refining Co., of Muskegon, will mean the immediate construction of a vapor phase reformation unit through the T.V.P. Corp. at a cost of about $200,000. Bids have been asked with contracts expected to be let before April 1. It is expected to complete the unit within 90 days, or about July 1, John Borden, president, said.

Old Dutch is just completing installation of a new tube still with a 100-foot stack at a cost of about $20,000, increasing the capacity to 4,500 bbls. a day. The new unit will handle up to 1,500 bbls. of charging stock daily. R. B. Leydig has been employed as construction engineer.

Naph-Sol Refining Co. also has ordered a new 102-foot bubble tower, the largest in the state, to be erected at the North Muskegon plant within about three weeks. It will increase capacity to about 4,500 bbls. Naph-Sol last year installed a Dubbs cracking unit to which some additions and changes recently have been completed. The new Naph-Sol tower will be 6 feet in diameter and will weigh 52 tons.

Several smaller units have been completed recently or are nearing so. Inter-Lakes Refinery Co. is completing a 1,000-bbl. plant near Detroit scheduled to start about April 1. Officers were elected recently as follows: President, Ross J. Campbell; vice president, Bernard L. Snyder; secretary, Edward H. Yost, and treasurer, Roland O'Neil.

Pentagon Oil Co. has completed a 2,000-bbl. plant at Plymouth, near Detroit, under E. G. Guy, supervisor of construction.

North American Petroleum Co., a new $1,000,000 concern, has announced plans to rebuild the 500-bbl. Peerless Oil Co. plant at Saginaw, increasing its capacity to 3,000 bbls.

Wolverine Petroleum Construction Co. is finishing a 1,000-bbl. plant in Alma, where Northern Refineries, Inc., recently was organized to build another plant.

Petroleum Chemicals Co., a $1,000,000 concern, has purchased 9 acres of waterfront property in Grand Haven, about 12 miles south of Muskegon, as the site for a $300,000 plant with capacity of 2,000 bbls. George Henry Flynn, Detroit, is back of the project. Hurley Brothers, Tulsa, will make plant plans. A process developed by Dr. Alexander Ramage will be utilized in manufacture.

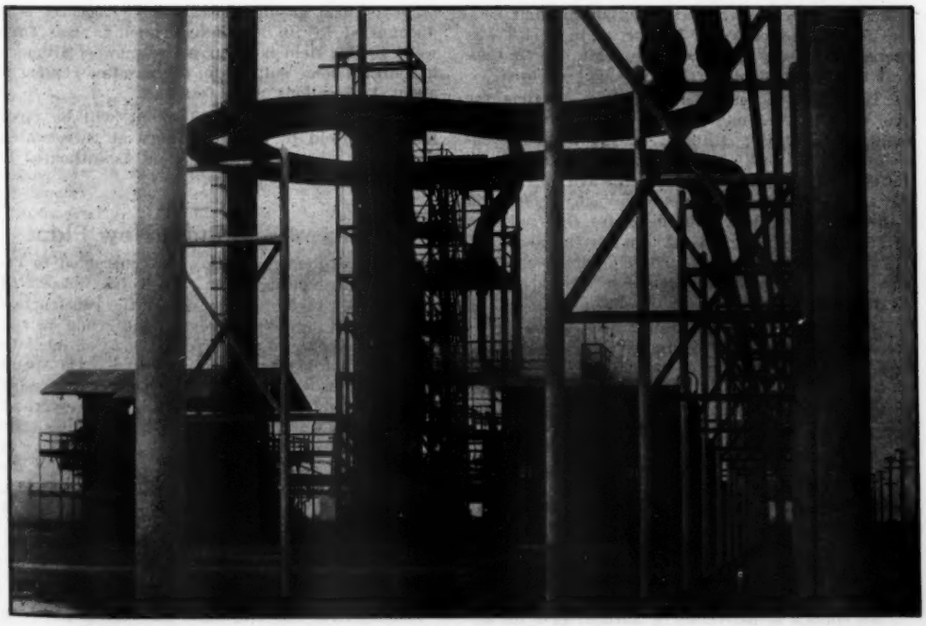
Carl J. Westlund, former Muskegon manager for Cardinal-Dixie Oil Co., has formed the Producers Refining Corp., of Ogemaw, which will erect a 1,500-bbl. plant at West Branch. Work has been started.

American-Petro Chemical Co., Wayne, recently completed a modern plant with a capacity of 1,200 bbls. a day. The new 1,500-bbl. plant of Inland Refineries, Inc., at Drayton Plains also has been completed recently.

Kent Refining Co., Grand Rapids, has been shut down pending reorganization. Lakeland Refinery Co. is a new project at Lansing, state capital.

State Refining Co., a $125,000 concern, proposes to build a 1,000-bbl. plant at Grand Rapids. Swanson Oil Co. has announced plans to erect a 1,000-bbl. plant.

Other Michigan plants include Crystal Refining Co., Carson City; Keystone Oil Refining Co., Detroit; McClanahan Refineries, Inc., St. Louis; Midwest Refineries, Alma.; Pure Oil Co., Midland; Roosevelt Oil Co., Mount Pleasant; White Star division, Socony-Vacuum Oil Co., Inc., Trenton; Superior Oil Corp., Elsie; Sweet Oil Refining Co., Wyman; Standard of Indiana, Zilwaukee (shut down); Central Refining Co., St. Louis, and Sovereign Refining Co., Saginaw.



Six thousand-barrel utility distillation unit used for processing special stocks. It is located in the Pan American plant at Texas City, Tex.

Western Refiners Program for Annual Meeting

The twenty-fourth annual meeting of the Western Petroleum Refiners Association, April 6, 7 and 8, at the Elms Hotel, Excelsior Springs, Mo., appears, both from quality of the program and the large advance registration, likely to be one of the best meetings the association has held.

Monday, April 6, will be devoted to meetings of committees. Starting after luncheon on Tuesday, reports will be made by the tractor fuel committee; manufacturers lubricants committee; diesel fuel survey committee; octane brackets committee; W.P.R.A. specifications committee; committee on posting tankcar prices; and road oil committee.

The morning session Wednesday will be opened by C. M. Boggs, who will make the president's annual address. Following appointment of committees, there will be a resolution on the death of P. M. Miskell by George D. Locke, Barnsdall Oil Co.

Willis Crane, of the Washington office of the Western Petroleum Refiners Association, will make an address on taxation, which will be followed by remarks by Fayette B. Dow, Washington counsel.

C. E. Arnott, Socony-Vacuum Oil Co., will address the convention on "Cooperation."

Dr. George G. Brown, University of Michigan, will deliver an address on "Alcohol as Motor Fuel," and Ralph Horween, of Topliff & Horween, Chicago, will speak on "Social Security Legislation." One other speaker and subject will be announced later.

Reports of special committees, and election of officers and directors will close the meeting. A meeting of the board of directors will follow immediately after adjournment.

New Pool in Michigan

MUSKEGON, Mich., Mar. 16.—Several hundred feet of oil was struck Sunday in Mountain Oil & Gas Co. No. 1 Archie Walter, SW NW NE section 17-11n-2w, Emerson Township, Gratiot County, indicating possibilities of a new central Michigan field about half way between Crystal and Porter.

The drill unexpectedly topped Dundee pay before the hole had been cased. Drilling operations were suspended to set casing and tanks when oil rose about 1,000 feet in the hole. The new find was heralded as the most important in Michigan this year.

Natural Gas News

Oklahoma Natural Gas Co. to Plan Reorganization

Reorganization of the Oklahoma Natural Gas Co. will be brought about through a new financing program, and enlargement through consolidation of subsidiaries.

The plan is not a sale, but a reorganization of the financial structure so as to strengthen the firm and to allow it to expand.

"There will be no change in official personnel or management or otherwise," said President Robert W. Hendee.

The following announcement was issued by Stone & Webster & Blodgett, Inc., fiscal representatives of New York:

"Stone & Webster & Blodgett, Inc., have developed a plan to be submitted to directors of Oklahoma Natural Gas Co. for the refunding of all of the present debt of the company and its subsidiaries except $250,000 of 4 per cent notes. The new securities proposed consists of $20,000,000 first mortgage bonds, $11,000,000 convertible debentures and $2,220,000 convertible prior preference stock.

"Coupon rates, maturities, conversion rates and other details are to be determined later.

"They state that in their opinion a substantial reduction in the present excessive interest and sinking fund requirements can be accomplished to an extent that will improve the position of the present preferred and common stockholders.

"Conditioned on the consummation of such a plan of refinancing, a group of investors have agreed to purchase, severally, a substantial amount of the stock of Gas Utilities Co., which owns approximately 83 per cent of the common stock of Oklahoma Natural Gas Co. with the intention of liquidating Gas Utilities Co. upon completion of which these investors will own the common stock of the company, but in no instance will any one of them own or control as much as 10 per cent of the voting control.

"In addition to the elimination of the holding company, Gas Utilities Co., it is the plan to further simplify the corporate structure by the transfer to Oklahoma Natural Gas Co. of the assets of its present subsidiaries — Midwestern Oil & Gas Co., Southwestern Natural Gas Co., Muskogee Natural Gas, Inc., Texokan Oil Corp., Oklahoma Natural Building Co. and Gas Producers Co.

"The investors who have made this conditional purchase agreement include among others, Stone & Webster, Inc.; Niagara Shares Corp., Schoellkopf, Hutton and Pomeroy, Inc.; Blythe & Co., Inc.; Kidder, Peabody & Co.; Bosworth, Chanute, Loughridge & Co., Trail & Mittendorf, Inc., and Penn Investment Co.

"The Oklahoma Natural Gas Co. and subsidiaries produce, transmit and distribute gas to 520,000 people, including Oklahoma City, Tulsa and Muskogee. It sells gas to 122,709 domestic and commercial customers, 473 industrial customers and to eight other utilities. Its gross earnings in 1935 were more than $7,000,000."

Wichita Falls Findings Await Interpretation

AUSTIN, Tex., Mar. 16.—The effect of the findings of a jury in a Travis County District Court involving the gas rate in Wichita Falls will not be known until Judge Yarborough enters judgment interpreting the jury's conclusions on March 17 or March 30.

The jury found the gas plant's valuation was $1,250,000 compared to the commission's $1,036,587, the company's claim of $1,510,041 and city's $1,105,809.

Another finding was that the annual depreciation should be $25,000 per annum, compared to the commission's estimate of $20,000, company's $53,647 and city's $15,734.

The jury sustained the commission and the city in fixing 7 per cent as a return on the investment, whereas the company wanted from 8 to 10 per cent.

R. M. Birdwell, Texoma Natural Gas Co., Fritch, Tex.; and J. C. Hodges, Borger, Tex.

Company attorneys interpret the verdict as invalidating the railroad commission's order. The case grew out of an ordinance passed in 1931 by Wichita Falls city council reducing the gas rate from 67½ cents per 1,000 feet to 40 cents. The company appealed to the Railroad Commission, which set a rate of 61 cents, and from this order the company appealed to the court, contending the commission's rate would confiscate the company's property.

Attorneys for the state contend the verdict does not give the company a right to maintain its present rate in Wichita Falls. Company attorneys hold the Railroad Commission order has been knocked out and has no affect on the present rates.

Gas in Gaines County Test

FORT WORTH, Tex., Mar. 16.—Walsh and others No. 1 Averitt, section 228, Block G, W. T. R.R. Survey, 3 miles northwest of Seminole in Gaines County, West Texas, picked up 6,000,000 feet of gas at 4,892 feet with an increase at 4,910 feet. This gas was struck below sulfur water 4,813-15 feet, the water exhausting and giving the test another chance for production.

New San Angelo Supply

SAN ANGELO, Tex., Mar. 16.—A long-time supply of gas and one that comes in at a rock pressure of 730 pounds to the square inch as compared to recent pressures of 130 pounds in other wells, has it is said been assured for this city and Ballinger by the bringing in of a 24,000,000-foot gasser in the Overall pool south of Coleman. Recently Texas Public Service Co., owner of the gas, got two 8,000,000-foot wells in Coleman.

Natural Gasoline

Production of Natural Gasoline Unchanged During January

Production of natural gasoline in the United States during January, 1936, was practically unchanged from that of December, 1935, according to a report of the Bureau of Mines for that month. The daily average production in January was 4,949,000 gallons compared with 4,951,000 gallons in December. The most notable gains in output during January were recorded in the Oklahoma City field and the "rest of California," the former showing an increase of 926,000 gallons over December and an increase of 3,367,000 gallons over January a year ago. "Rest of state" in California increased 836,000 gallons and was 4,506,000 gallons higher than in January, 1935. Production in Kettleman Hills and in the Panhandle, the two leading fields, declined in January, 506,000 and 560,000 gallons, respectively. Production in East Texas increased 470,000 gallons while Gulf, North Central and West Central showed slight declines.

Total production for the various districts for the month of January was as follows: Appalachian, 6,820,000; Illinois, Michigan and Kentucky, 978,000; Oklahoma, 34,936,000; Kansas, 3,146,000; Texas, 44,331,000; Louisiana, 5,173,000; Arkansas, 935,000; Rocky Mountain, 5,041,000, and California 52,066,000. All the above figures being in gallons. The total production for the month of all the districts was 153,426,000 gallons as compared with 153,468,000 gallons in December and 138,039,000 gallons in January, 1935.

Stocks of natural gasoline increased both at refineries and at plants and terminals, this increase marking a reversal of the downward trend which began in June, 1935. On January 31, 1936, total stocks of natural gasoline amounted to 167,312,000 gallons, compared with 155,316,000 gallons on hand at the beginning of the month. Total stocks at refineries increased 5,880,000 gallons while stocks at terminals and plants increased 4,116,000 gallons. Increase in stocks in California and Texas accounted for the majority of the increase while total stocks in Oklahoma remained practically the same, increasing but 175,000 gallons during the month.

All classes of deliveries of natural gasoline declined during the month, the decrease in shipments to the East Coast and foreign countries being particularly severe. Because of seasonal influences, the vapor pressure of all major movements increased in January, and it is probable that the weighted average for all shipments, 21.54 pounds, will prove to be the high point for 1936.

Gulf Plans Erecting Gasoline Plant in O'Brien Field

FORT WORTH, Tex., Mar. 16.—Gulf Oil Corp. of Pennsylvania is planning to erect a 20,000,000-foot daily capacity, low-pressure absorption natural gasoline plant in the O'Brien field in northern Ward County, Texas, where the company has a large block of acreage developed over the past few years. Plans call for the installation of 10 compressor units with two auxiliaries. Much of the equipment is to be brought from Oklahoma where other natural gasoline plants have recently been dismantled by an associate company. Gas from wells in this field is comparatively sweet although it contains some sulfur and the gasoline content is about 1.25 gallons per 1,000 feet.

Gasoline stripped in the plant will be piped from the field to Gulf's refinery at Sweetwater, Tex. Cost of the proposed plant is estimated to be approximately $450,000.

Continental to Build New Plant

The Continental Oil Co. has contracted to Petroleum Engineering, Inc., of Tulsa, associated with Arthur G. McKee & Co., for the construction of a complete gasoline recovery and crude oil stabilization plant to be erected on Continental's Tepetate holdings near Eunice, La. The plant when completed will have a capacity for processing 50,000,000 cubic feet of gas daily at a pressure of 300 to 500 pounds. Also the plant will stabilize high gravity crude to 42 gravity for shipment to the Continental refineries. It is reported that the expenditure involved is approximately $200,000. Work is to start at once and the plant is expected to be completed in 10 weeks.

Absorption Plant Construction

CALGARY, Alberta, Mar. 14.—Work has been commenced on the superstructure of the new gasoline absorption plant of British-American Oil Co. in South Turner Valley.

Pipe Line Activity

General Petroleum Will Lay 80-Mile Line to Estero

LOS ANGELES, Calif., Mar. 16.—Seaboard Oil Co. and Texas Co. will soon start construction work on a new California pipe line which will extend from Kettleman Hills to tidewater at Estero in San Luis Obispo County. The new company will be incorporated in California as the Valley Pipe Line Co. and will be owned jointly by Seaboard and Texas Co. The line will be 10 inches in diameter and tentative plans call for electric welding. Rights of way are being secured and the route to be followed will be along the same general area followed by Standard Oil Co. when laying its two pipe lines from Kettleman Hills a few years ago. Engineering details are being worked out and construction work is expected to get under way about July 1 and the entire 80 miles should be ready for operation before the close of 1936. Only two pump stations will be required and as it is not the present intention to store any oil along the line, tankage will be erected only at Estero, where four steel tanks, with a capacity of approximately 118,000 bbls. each, will be erected. Probable cost, which is at present only tentative pending completion of engineering details, will approximate $800,000. The submarine loading line will be of conventional construction and approximate 2,500 feet in length.

Seaboard Oil Co. and Texas Co. have been considering the advisability of building this new line for the past several months. The matter came to a head last October when inadequate pipe line facilities prevented the Kettleman North Dome Association from obtaining maximum production when the Kettleman North Dome field was supposed to be producing wide open. This field has never produced wide open but was producing as much as the outgoing pipe line could handle.

General Petroleum, which has been moving a large part of this oil to Los Angeles Basin, enlarged its pipe line facilities late last year by laying a new 8-inch line from Lebec to Torrance and making other necessary improvements in pump facilities. Sumner C. Bryant, a member of Texas Co.'s legal staff, has been loaned to Valley Pipe Line Co. to facilitate incorporation and consolidate activities.

Stanolind Replacement

Stanolind Pipe Line Co. is replacing some of its old pipe in certain sections of its trunk system in Missouri, with new seamless or electric longitudinal welded pipe of modern design and girth welds. Sheehan Construction Co. has the job well under way.

Washington Gasoline Lines

WASHINGTON, D. C., Mar. 16.—The construction of pipe lines in the District of Columbia is authorized in a bill introduced in the house by Representative Tonry of New York, and now in the hands of the committee on the District of Columbia. Through the commissioners for the District permission would be given to Steuart Brothers, Inc., owners of the property, to construct and maintain five pipe lines for petroleum products.

The Steuart properties are in what is known in Washington as "Square 1024," bounded by L Street southeast on the north, Twelfth Street southeast on the west, Thirteenth Street southeast on the east and the right of way of the Philadelphia, Baltimore & Washington Railroad on the south. The lines which are to run from a point north of the railroad right of way, through Thirteenth Street to the Anacostia River, are expected to carry gasoline.

Two pipe line companies operating gasoline lines north of the city of Washington stated they knew nothing of the proposed project.

Rodessa Line Progress

FORT WORTH, Tex., Mar. 16.—Eastern Texas Petroleum Co. has completed about 75 per cent of its 57-mile oil line from the Rodessa field to the company's refinery and tank farm at Longview. This is an 8-inch screw line.

Progress on Loma Novia Line; Lines in Pearsall Field

SAN ANTONIO, Tex., Mar. 16.—The Crude Oil Pipe Line Co.'s new 80-mile oil line from the Loma Novia field in Duval County to deep water at Corpus Christi is progressing eastward with pipe strung and welded to a point east of Alice, about half the distance to the coast. Crude is being pumped in the first section laid from the field to a loading rack at San Diego, whence it is being shipped to Corpus Christi and other points by rail pending completion of the line. N. A. Saigh Co. of San Antonio is laying the line for Crude Oil Pipe Line Co. Completion is anticipated April 1.

A new field line connecting the loading rack of Amerada Petroleum Corp. at Melon, Tex., with the Pearsall field, a short distance west, is being laid. The new 6-inch line will replace the original 3-inch line laid recently. In the field, 6-inch lines are being laid to the new Austin Chalk production of the company in the southwest part of the field. N. A. Saigh Co. of San Antonio is laying the lines under contract with Amerada Petroleum Corp.

At Melon two 55,000-bbl. tanks are being erected to care for storage of the field production. Heretofore one 500-bbl. tank was the only storage necessary at this point. Two 55,000-bbl. tanks are located in the field.

Garden Island Contract

HOUSTON, Tex., Mar. 16.—Texas Pipe Line Co. has awarded contract to Apex Construction Co. of Houston for construction of a 6-inch welded pipe line from the Garden Island field in Plaquemines Parish, Coastal Louisiana, to Pilot Point, a distance of 9 miles. At present the oil is barged from the field to Pilot Point where it is loaded on tankers.

Arizona Gas Extension

Western Gas Co., El Paso, Tex., is working on a 6-inch, 45-mile extension of its main pipe line to serve the Magma Copper Co. at Superior, Ariz., according to A. L. Forbes, Jr., general superintendent. The new line will tap the company's El Paso-Phoenix pipe line near Casa Grande. The Magma Copper Co. changeover is the second smelter conversion to natural gas in Arizona, the first being the Phelps Dodge plant at Douglas about two years ago. While the smelter will constitute the principal load of the new line, it will also supply domestic consumers in the town of Superior.

Rain slows up construction of East Texas Refining Co. 8-inch line from Rodessa, La., to its refinery at Longview, Tex.

Refinery Work

New Refinery and Specialty Plant to Be Built at Dyer

The H. A. Montgomery Co., manufacturing chemists at Detroit, Mich., are now constructing the first unit of its new plant situated at Dyer, near Findlay, Ohio. This unit will be a lubricating oil refinery consisting of two vacuum stills with a combined capacity of approximately 1,000 bbls. per day. The refinery will run on Mid-Continent crude, producing naphthas, kerosene, mineral spirits, light fuel oil, high-grade neutrals and residuals, but no motor gasoline.

This company, which has been engaged for many years in the manufacture of a complete line of highly specialized oil and chemical products common to the metal-working industries in Detroit, proposes to add to the refinery unit a chemical processing plant for production of their various specialties.

Russell Crothers, chief engineer of the company, who is in charge of construction, has been active in refinery operation and petroleum research in Cincinnati in past years. J. W. Laws, Jr., formerly wholesale manager for the Sun Oil Co. at Detroit, has been appointed vice president in charge of general sales for the new operation.

McColl-Frontenac to Increase Clay Treating Capacity

TORONTO, Canada, Mar. 14.—McColl-Frontenac Oil Co., Ltd., has arranged with the Gray Processes Corp. for a substantial increase in its clay treating capacity. Part of the increase represents an enlargement in throughput of existing equipment, while the remainder was arranged in order to take care of the production of cracked and reformed gasoline expected as a result of proposed additions to the existing cracking equipment.

Gray towers are used in both the Toronto and Montreal refineries of the company, the former plant, then owned by McColl Brothers, Ltd., being the site of the first Gray tower installation in Canada, taking place in 1925. Other towers were installed by Frontenac Oil Refineries, Ltd., at Montreal prior to the merger of the two companies.

St. Helens Building Ethyl Plant

LOS ANGELES, Calif., Mar. 16.—The St. Helens Petroleum Co. has started installation work on a new Ethyl blending unit at its Pico refinery in Los Angeles Basin and this work should be completed within another 30 days. To increase plant efficiency, the company has also started installing a new pressure vessel which will operate in conjunction with existing equipment as a continuous treater. St. Helens is branching out into the lubricating oil market and will soon have its new Pennsylvania grade motor oil at distributors in package form.

New Weyburn Refinery

WEYBURN, Saskatchewan, Mar. 14.—The Soo Refinery, Ltd., is completing construction of its plant here and expects to start operations within a few days. The first shipment of crude from the Oklahoma and Texas fields will arrive about March 15. The project is financed and officered by Weyburn men, the officers including: President, G. F. Shaw; vice president, A. Wedin; secretary treasurer and manager, A. J. Onstad.

Surprisingly Strong Demand Is Shown By Report on Refinery Products

A surprisingly strong situation in the demand for practically all refinery products was shown in the Bureau of Mines report covering January operations, released during the past week. The most outstanding development was the heavy demand for motor fuels during the first month of the year.

The government report, as summarized in the accompanying table, showed a gain of 21 per cent in export demand for motor fuels, 12.4 per cent in domestic shipments, with an increase in total demand (domestic demand plus exports) of 16.3 per cent. In analyzing the significance of these comparisons it is necessary to keep in mind that the motor fuel demand in January, 1935, was exceptionally low, with a decrease of about 5 per cent when compared with January, 1934. Later government reports for 1935 showed the January shipments were not representative and were due to some temporary situation in that month. If January, 1935, shipments had been normal in relation to those of later months, the indicated total demand in January, this year, would have been around 8 per cent greater and not 16.3 per cent as shown in table.

This 8 per cent increase is in line with the predicted gain for the first quarter of 1936 over the same period in 1935 and indicates the unfavorable weather during the latter part of January did not slow up motor fuel demand as much as was predicted at the time. Recent private estimates have indicated that due to the low temperatures in January and February, consumption might not show any increase over first two months of 1935.

Based on refinery shipments, the demand for other refinery products was satisfactory in January, with a 20 per cent gain in kerosene, 12.2 per cent in fuel oil and gas oil, and 23.4 per cent in petroleum wax. The lubricating oil demand showed a small decline.

The data on supply for both crude oil and refinery products show in general that phase of operations kept pace with the shipments. The large increase in crude runs to stills in fact brought greater additions to motor fuel stocks during the month than was considered desirable for that month. Due to the large gain in refinery supply, the reductions in fuel oil and gas oil stocks in January were no greater than is considered normal for that month. The sensational gain in kerosene shipments probably in part reflects the fact that some refiners were forced to ship and blend that product with distillates to take care of the demand for furnace oils.

Crude Oil and Refinery Situation Summarized—January 1936-1935

Supply and Demand—Crude Oil (Bbls.)

January—	Total supply	Total demand	Excess Demand	Excess Pct.	Domestic production	Imports	Indicated domestic demand‡	Exports	Stocks refinable crude Jan. 31
1936	90,586,000	92,136,000	1,550,000	1.7	88,711,000	1,875,000	89,069,000	3,067,000	313,081,000
1935	80,726,000	79,806,000	*900,000	*1.1	78,715,000	2,011,000	77,437,000	2,369,000	338,174,000
Increase, 1936	9,860,000	12,330,000	.....	....	9,996,000	*136,000	11,632,000	698,000	†25,093,000
Increase, 1936	12.2%	15.4%	.....	....	12.7%	*6.7%	15.0%	33.9%	†7.4%

Supply and Demand—Refinery Products—Motor Fuels (Bbls.)

January—	Total supply	Total demand	Excess Demand	Excess Pct.	Domestic production	Imports	Domestic demand	Exports	Stocks Jan. 31§
1936	40,492,000	35,125,000	*5,367,000	*13.2	40,492,000	.....	32,553,000	2,572,000	66,549,000
1935	36,236,000	30,187,000	*6,049,000	*20.0	36,236,000	.....	28,062,000	2,125,000	63,135,000
Increase, 1936	4,256,000	4,938,000	.....	....	4,256,000	.....	4,491,000	447,000	3,414,000
Increase, 1936	11.7%	16.3%	.....	....	11.7%	.....	12.4%	21%	5.4%
Kerosene									
1936	4,761,000	6,077,000	1,316,000	2.1	4,761,000	.....	5,569,000	508,000	6,599,000
1935	5,011,000	5,021,000	10,000	.2	5,011,000	.....	4,299,000	722,000	6,388,000
Increase, 1936	250,000	1,056,000	.....	....	250,000	.....	1,270,000	†214,000	211,000
Increase, 1936	5%	20%	.....	....	5%	.....	29.5%	†29.6%	3.3%
Gas Oil and Fuel Oil									
1936	38,195,000	41,678,000	3,483,000	9.1	37,080,000	1,115,000	38,682,000	2,996,000	100,501,000
1935	29,841,000	37,136,000	7,295,000	24.4	28,869,000	972,000	34,589,000	2,547,000	104,174,000
Increase, 1936	8,354,000	4,542,000	.....	....	8,211,000	143,000	4,093,000	449,000	*3,673,000
Increase, 1936	28.0%	12.2%	.....	....	28.4%	14.7%	11.7%	17.6%	*3.5%
Lubricating Oil									
1936	2,309,000	2,207,000	*102,000	*4.6	2,309,000	.....	1,396,000	811,000	7,127,000
1935	2,175,000	2,406,000	231,000	10.6	2,175,000	.....	1,557,000	849,000	7,100,000
Increase, 1936	134,000	†199,000	.....	....	134,000	.....	†161,000	†38,000	27,000
Increase, 1936	6.1%	†8.2%	.....	....	6.1%	.....	†10.3%	†4.4%	.4%
Petroleum Wax (Lbs.)									
1936	47,008,000	43,047,000	*3,961,000	*9.2	44,800,000	2,208,000	24,901,000	18,146,000	118,636,000
1935	40,005,000	34,889,000	*5,116,000	*14.6	36,960,000	3,045,000	19,188,000	15,701,000	141,252,000
Increase, 1936	7,003,000	8,158,000	.....	....	7,840,000	†832,000	5,713,000	2,445,000	*22,616,000
Increase, 1936	17.5%	23.4%	.....	....	21.2%	†27.4%	29.9%	15.5%	*16.0%

*Excess supply. †Decrease. Note—Total supply equals domestic production plus imports. Total demand equals domestic demand plus exports. Data on demand for refined products are based on refinery shipments. ‡Crude oil only. §Includes finished, unfinished refinery gasoline and natural gasoline.

Crude Oil Runs to Stills and Total All Oils (Bbls.)

January—	Total imports§	Total exports§	Total crude to stills	Per cent yield gasoline	Nat. gasoline production	Total supply all oils*	Total demand all oils*	Stocks all oils Jan. 31
1936	3,563,000	10,162,000	85,776,000	46.1%	3,936,000	96,222,000	96,587,000	541,335,000
1935	4,084,000	8,780,000	75,456,000	46.8%	4,530,000	86,232,000	85,001,000	568,301,000
Increase, 1936	†521,000	1,382,000	10,320,000	†.7%	†594,000	9,990,000	11,586,000	†26,966,000
Increase, 1936	†12.7%	15.7%	13.7%	.....	†13.1%	11.6%	13.6%	†4.7

*Total all oils includes crude refined products, natural gasoline and benzol. †Decrease. §Includes crude oil and refinery products. In case of gas oil and fuel oil and wax, imports include only products for domestic use. All data based on Bureau of Mines reports.

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Oil News from Foreign Lands

Firm Protest Against Mexican Attitude to Business

MEXICO CITY, Mex., Mar. 14.—Oil companies are particularly interested in the results of a protest sent this week to President Cardenas by associations and chambers of commerce, representing approximately 90 per cent of the invested capital in the country, regarding the injustices suffered by business largely due to the attitude of the government. Considerable crude oil production is shut in at this time due to the refusal of oil companies to accede to the unusual demands of labor.

Considerable labor trouble has been experienced during the past two years and there are several cases in which, due to the rulings of the federal labor board, oil companies have been practically forced to agree to demands of labor unions. These operations, it is said, will have to to be curtailed or shut down entirely unless the employers are able to secure changes in the present rulings covering pay, hours of employment, insurance and other features of employment.

MEXICO

The memorandum sent to President Cardenas asks for a clear-cut indication of the trend of governmental policies affecting relations between employers and workers. It energetically protests against the absence of a fixed policy—of a law in effect; and states that without this line of conduct, equal for all and obligatory for all, the political and economic life—and even social life—of the country is impossible.

The statement asks, among other things, for labor legislation that is fair to both sides; that the president lend an ear equally to employer as well as labor syndicate leaders on questions at issue; and that the basic principle of the right of property (recognized under the constitution) be neither weakened nor destroyed.

The memorandum reminds the president of a recent statement attributed to him in Monterrey that "private enterprises weary of the social struggle can turn their industries over to the workmen or the government."

"We do not believe that you made this statement with the intention and effect with which it has been accepted," says the memorandum. "But we are compelled to state that we will not turn over and cannot turn over our factories, our businesses and our companies, because we have a purpose and a responsibility to fulfill; because the laws protect us, and because in many instances we are merely the administrators of capital belonging to others which has been invested under the protection of those laws."

"There is no letup in this unending strife, daily growing more bitter, promoted by labor leaders," says the memorandum. "The result is that all plans collapse, foresight in business is useless, and the most flourishing enterprises remain in the impossible position of being unable to visualize even the balance in losses or profits. This is due to the fact that contracts are not respected by the workers and boards of conciliation and arbitration disregard these conflicts unless the parties bow to their jurisdiction. "As a logical result of this uncertain and precarious situation, bank credit for industries and even for commercial firms is being restricted and might even be completely suspended. Capital is extremely cautious and keeps away from such places where guarantees are lacking or where these guarantees are weakened."

The statement alludes to what it terms the president's oft-repeated statement that it is "his firm desire to comply with the laws, and to have them complied with by all parties," but it reminds him that in practice this is not always effected. It quotes him as recently saying "that the laws must be interpreted in a revolutionary sense," pointing out that this statement likewise has given rise to innumerable and serious abuses committed by the authorities because of its extreme elasticity.

"In the supreme court there are judges who, declaring themselves to be revolutionists before judges, interpret the law almost systematically with the intent of causing the most trouble to the employer simply because he is an employer."

Citing the actions of the boards of conciliation and arbitration, the statement charges that "the employers fail to get any real guarantees and in general their rights are not respected; the workmen break their labor contracts whenever they please, arguing there is no balance between the elements of production as if the lack of compliance with these contracts was not precisely the cause of the evils which they themselves provoke. Thus the contract only creates obligations for the employer and never for the laborer."

The statement inquires if arbitration is not compulsory what was the object of creating these boards? Pointing out that as arbitration is voluntary, the statement accuses the boards of limiting their activities to counting the number of strikers and declaring the strike legal. It alleges that the employer without an opportunity for defense—and overwhelmed by the losses he is sustaining and the looming danger of bankruptcy—gives in to the demands of the workers regardless of how exaggerated and unjust they may be. This explains, continues the statement, the alarming number of strikes declared without interruption in Mexico City, Pueblo, Monterrey and the coastal cities of Tampico, Mazatlan and Vera Cruz.

The statement describes the signatory groups as working men who, under the constitution and laws, have created industries, businesses and commercial activities which represent a substantial part of the nation's wealth. It describes these groups as desiring to collaborate with the constituted authorities and as recognizing the evolution of contemporary thought.

It continues: "We are the first to desire that Mexico take a leading place in this interesting evolutionary process and we assert that the ideas and the frankly protective laws for the workmen neither surprise nor alarm us. What we do energetically reject, through a legitimate instinct of preservation, is the absence of a fixed policy, of a law in effect, of a definite and clearly stated trend, because without this line of conduct, equal for all and obligatory for all, the political and economic life—and even the social relations—are impossible."

First Test in Anzoategui Field Started by Standard

Standard Oil Co. of Venezuela has started its first test well in the State of Anzoategui, eastern Venezuela. It is Canoa No. 1 in the district of Independencia and is last reported drilling below 1,000 feet.

The production of crude petroleum in Venezuela for February, 1936, amounted to 12,505,792 bbls,, a daily average of 431,234 bbls. This daily average represents a substantial increase over both January of this year and February, 1935.

VENEZUELA

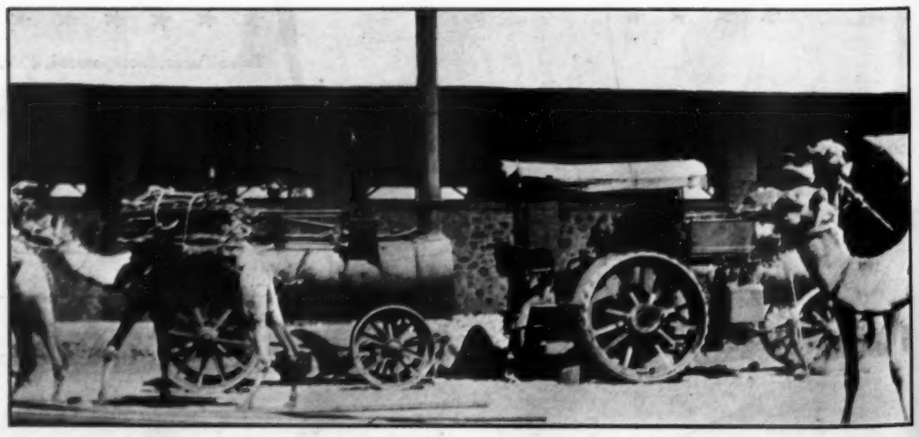
The largest barrelage increase in February compared with the same month of last year was registered in the Lagunillas oil field, where production increased from 6,178,364 bbls. to 7,039,666 bbls., a gain of 861,302 bbls., or approximately 14 per cent. The largest percentage gain was recorded in the Quiriquire field, where output advanced from 1,291,012 bbls. a year ago to 1,729,235 bbls., an increase of 438,223 bbls., or about 34 per cent. Decreases in production were shown in some of the smaller fields, including Mene Grande, Cumarebo, Concepcion, El Mene and La Paz.

Production of the Lago Petroleum Corp. for February totalled 4,136,887 bbls., a daily average of 142,651 bbls. This is close to the peak daily average figure for this company, which is the leading Venezuelan producer. The production of the Creole Petroleum Corp. (Standard of Venezuela) amounted to 2,311,330 bbls., a daily average of 79,701 bbls., compared with 1,768,092 bbls., or 63,146 bbls. daily, in February, 1935.

The following table shows crude oil production in Venezuela by fields and companies, for February, 1936, and February, 1935 (figures in barrels):

	February	
By fields—	1936	1935
Lagunillas	7,039,666	6,178,364
La Rosa-Ambrosio	1,978,733	1,500,754
Quiriquire	1,729,235	1,291,012
Mene Grande	960,915	1,070,600
Tarra	413,443	439,600
Cumarebo	210,771	229,327
Concepcion	99,209	117,000
El Mene	60,254	78,400
La Paz	13,566	15,500
Total	12,505,792	10,920,557
Daily average	431,234	390,020
January	417,179	405,156
By companies—		
Lago Petroleum Corp.	4,136,887	3,599,033
Venezuelan Oil Concessions, Ltd.	3,225,809	2,728,500
Creole Petroleum Corp.	2,311,330	1,768,092
Venezuelan Gulf Oil Corp.	1,355,000	1,179,000
Caribbean Petroleum Co., Ltd.	960,915	1,070,600
Colon Oil Corp.	413,443	439,600
British Controlled Oilfields	60,254	78,400
North Venezuelan Petroleum, Ltd.	42,154	57,332
Total	12,505,792	10,920,557

The trustee under the plan of reorganization of the Colon Oil Corp. has submitted his report, indicating his view that the modified plan, allowing greater participation on the part of stockholders, was fair and should be adopted. Judge Goddard also indicated that he considered the plan equitable and set a further hearing for March 15.



Camels hold their own in Addis Ababa, because of high cost of gasoline

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Recovery Plus

The petroleum refining industry today has the unique distinction of not only having fully recovered from the depression but of having actually passed its previous peak in volume of business and strengthened its position for the future.

It has been able to accomplish this achievement by improvement in manufacturing operations, as explained in this issue, through perfecting processes resulting in greater efficiency and improved products. This increase in manufacturing efficiency has permitted the refining industry to offer the public products of greater value to the user at relatively less cost.

Superior motor fuel has permitted the automotive manufacturer to produce an engine of a design that would not have been feasible five or ten years ago while improved lubricating oils have simplified the problems of users of automotive and industrial equipment. The user of motor fuels and lubricants is getting more for his money because of this scientific advancement in the manufacture of petroleum products.

This costly and laborious progress on the part of the refining industry has been justified not only by its influence in assisting the industry to recover from the depression and attaining a new record in volume of business but because it has established refining on a higher and more stable level.

It is obvious that as manufacturing processes become more complex, as for instance, polymerization of gases for production of motor fuels and solvent refining in the manufacture of superior lubricants, the requirements for the production of superior products will tend to stabilization of the industry.

Petroleum refining today is no longer concerned almost exclusively with the manufacture of its familiar major products. It has, for example, definitely entered the chemical field in the production of chemicals from petroleum as a base, particularly true in polymerization. This is recognized as merely a beginning in a field of illimitable possibilities and one promising proportionate returns. When it comes to cost and utility no substitute can compete with petroleum.

This has been sufficiently demonstrated by the fact that, despite the trend towards higher prices in other lines, in some cases fifty or a hundred per cent, the oil industry has been able to market its major products at little or no advance over the prices during the worst period of the depression.

The oil industry is still a long way from the 1926 level on other products, a fact that has been successfully accepted by the manufacturing division as a challenge to greater effort. As a consequence petroleum products are entering new fields and expanding in old fields as improved quality and value widen their usefulness, enlarging business to new records.

Good news—good business

"Octane number has no meaning unless the engine and conditions of determination are rigorously specified"—*E B Evans, E M Dodds and F H Garner in Journal of Institution of Petroleum Technologists, Vol 21, No 146*

That's right

Octane number by itself merely tells the motorist whether a gasoline will knock under certain conditions in a particular engine—not his own engine

But the high octane number in Dubbscracked gasoline is linked with other distinctive characteristics of its own that give more power, more silent miles to the gallon than other fuels—in every engine under all conditions—everywhere and always

Good news to the motorist

That good news is spreading fast and it brings good business to Dubbs refiners

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Oil Industry Still Too Young to Show the Span of Life of an Oil Region

By JAMES McINTYRE

What is the life of an oil region? How long will the Mid-Continent produce oil? Or the Gulf Coast? Or any other of the fields that have come in within the past 35 years?

If the future can be judged by the past the Mid-Continent and other producing divisions that have come into existence as such in the twentieth century will be producing oil and drilling for it in 1975, unless there is no further use for petroleum by that time.

This is based on the record of the Appalachian fields, the oldest American oil producing region.

Our regular reports from the old Eastern or Pennsylvania Grade fields show that drilling operations are being carried on, and oil and gas wells completed regularly, in Allegany and Cattaraugus County, New York, a field over 55 years old; in McKean County, Pennsylvania, a 60-year-old field and in Venango County, Pennsylvania, which dates back to the Drake well in 1859, making the field nearly 77 years old.

A recent record in Pennsylvania shows the following number of drilling operations by counties: McKean 63, Venango-Clarion 17, Butler-Armstrong 5, Allegheny 2, Beaver 1, Crawford 1, Fayette 2, Greene 6 and Washington 12, a total of 109.

Oil was discovered in Venango County in 1859; in Clarion County in 1865; Greene County in 1861; McKean County in 1875; Butler County in 1870; Armstrong County in 1871; Allegheny County in 1877; Forest County in 1881, and Washington County in 1882. These counties are all in the above list.

In southeastern Ohio Counties the current drilling record is: Athens 2, Belmont 4, Carroll 1, Columbiana 3, Coshocton 2, Cuyahoga 1, Guernsey 3, Hocking 1, Holmes 1, Jefferson 1, Knox 3, Licking 3, Medina 6, Meigs 4, Monroe 2, Morgan 1, Muskingum 1, Noble 4, Perry 3, Washington 6, Wayne 1, a total of 51. In January 26 wells were completed in this group of counties and in December 40 wells.

Morgan County, Ohio, still producing oil and drilling for more, was opened as an oil area in 1860 in the Black Run district, and Washington County in 1860 in the Macksburg district, partly in Noble County. Coshocton County dates back to

Pithole field in Venango County, in the late 1860's. Operators in that county are still finding oil

1863 and Washington County to 1861 when the Cow Run field was opened. Knox goes back to 1885 when the Bladensburg pool was opened.

In West Virginia there are 24 counties in which wells are drilling including Boone 7, Cabell 14, Calhoun 7, Clay 1, Doddridge 2, Gilmer 2, Hancock 2, Harrison 1, Kanawha 18, Lincoln 2, Logan 2, Marion 2, Marshall 2, Mingo 2, Monongalia 2, Pleasants 5, Raleigh 1, Ritchie 16, Roane 5, Tyler 3, Wayne 2, Wetzel 5, Wirt 4 and Wood 1, a total of 108. Within these counties 42 wells were completed in January and 65 in December.

Wirt County, in which four wells are drilling is the cradle of oil in West Virginia. Oil was discovered in the Burning Springs district in 1860. In Ritchie County in which 16 wells are drilling, the Volcano field was opened in 1864. In the following year the Ogdin field was opened. Pleasants County was first productive in 1868 and Tyler County in 1870; Ritchie County in 1879, and Monongalia in 1886.

All the districts included in the above list were oil regions before the oil was discovered between California and the Mississippi River, and while the peak of their annual production was reached many years ago, they are still in a healthy condition, producing oil and gas profitably. Pennsylvania's largest production was in 1890, 28,458,000 bbls. Southeastern Ohio's yearly peak came in 1903, 5,587,000 bbls., and West Virginia's peak year was 1900, when it produced 16,196,000 bbls. The whole region now produces in normal weather about 70,000 bbls. of oil per day.

The oldest field in Oklahoma, the Nowata-Chelsea district, is being redrilled for the purpose of flooding the Bartlesville sand in the manner in which the Bradford field in Pennsylvania and the Allegany field in New York are flooded.

The Nowata-Chelsea district dates back into the latter part of the nineteenth century and the Bradford field goes back to 1875 with a peak production in 1881, yet both are active and productive many years after they began their descent from their best year.

Thus the question of the span of life of an oil region remains unanswered. The industry is yet too young to make an answer possible.

In the old Shinnston field in West Virginia. Operators in that state are busily engaged in oil production and engaged in deep drilling for buried oil and gas fields

Cities Service, Consolidated to Pool Interests in Richfield

New York, Mar. 16.—Cities Service has made an agreement with Consolidated Oil Corp. whereby the former's interests in Richfield Oil Co. of California will be transferred to Rio Grande Oil Co. in exchange for a 50 per cent interest in Rio Grande plus "other considerations." Consolidated, as owner of Rio Grande, will thus divide its control of the company and will help make Rio Grande the largest single creditor of the Richfield properties now undergoing receivership proceedings.

Oswald Lime Pool Opened in Stafford County, Kansas

A new Oswald lime pool has been opened in northeastern Stafford County, Kansas, by L. A. Farris and others No. 1 Snyder, SE SE NW section 3-21-11w. The wildcat was reported spraying oil at the rate of 125 bbls. daily, with gas gauging 5,000,000 feet. Production is from Oswald lime, topped at 3,070 feet, total depth 3,106 feet. It had not been tested. Location is just south of the Stafford-Barton County line, south of the Raymond and Ellingwood areas and about 4 miles northeast of the Peter pool, nearest production. It is further south than commercial production is usually found in Oswald lime in Kansas.

In the Lovell area of Logan County, Stanolind Oil & Gas Co. and others No. 1-A Gragg, SW SW NE section 20-18-4w, was producing 25,000,000 feet of gas daily and spraying distillate at the rate of about 15 bbls. a day. Total depth is 6,122 feet in Dolomite sandy lime. In the Edmond pool of Oklahoma County, Marathon Oil Co. No. 9 Dahl made 24-hour potential of 4,127 bbls., from second Wilcox sand pay at 6,559-6,675 feet. Gas gauged 27,850,000 feet daily.

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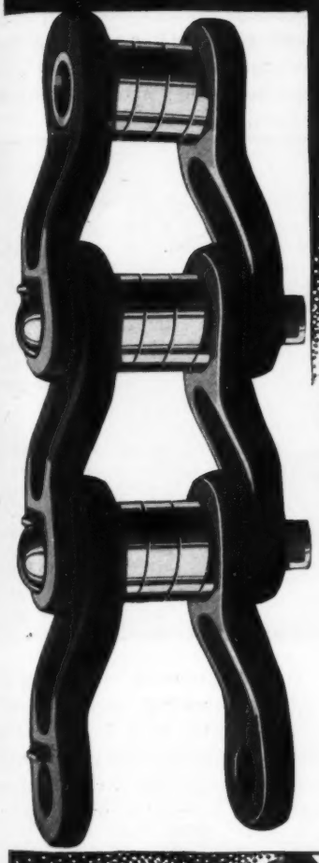

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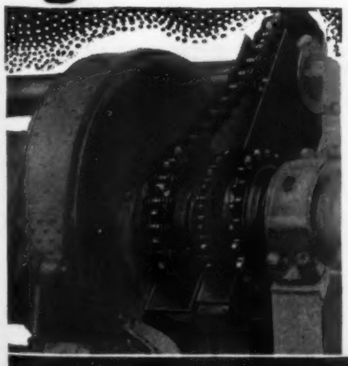

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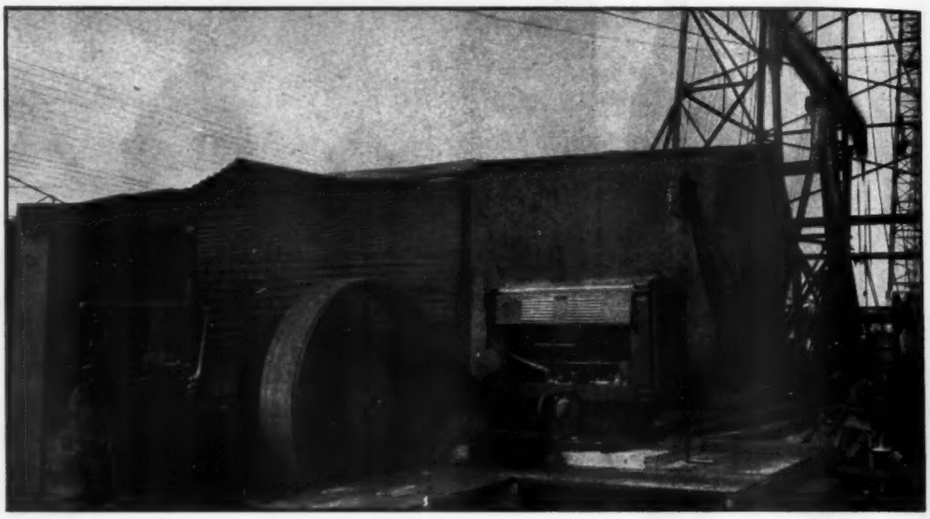
Steel Table for Rod Gangs

The rod and tubing gang of a major oil company has devised a unique table which has been found to be a great aid in keeping wrenches and rod hangers off the derrick floor and raising them to a height where they can be reached without stooping. The table was constructed from angle-iron, the top being made from sheet iron welded to the under side of the angles. Sucker rods were bent into V-shape and the ends welded to the angles to form the table legs. The table is portable and is taken with the rod gang as they move from one job to another.

Steam Engine Used as Countershaft for Pumping Oil Well

An oil company operating in Oklahoma City had been pumping the well shown in the picture with the steam engine shown but finding it expensive to fire the boiler necessary to produce steam decided some other method of pumping was needed which would still permit the use of the steam engine for servicing the well for such operations as pulling rods and tubing. The picture will reveal the decision of the management whereby the well is being pumped by a multi-cylinder gas engine, but the steam engine is still available for servicing operations as well as serving as a countershaft between the gas engine and the bandwheel. The regular fly wheel is removed from the engine and the large belt pulley shown is installed



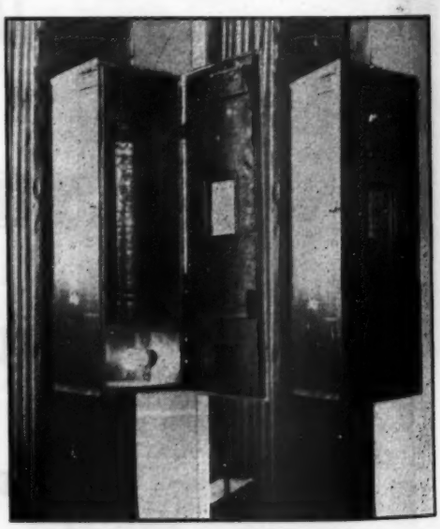
in its place and is powered from the gas engine. During ordinary pumping operations the connecting rod is detached from the crank on the steam engine eliminating work of powering an idle piston. In case the rods or tubing must be pulled from the well the belt pulley is removed from the crank shaft of the steam engine, the fly wheel put on, the connecting rod attached to the crank and the steam engine used to service the well on steam power. When the well is again ready to pump the gas engine may be used as prime mover.

Cover for Shaft End

A method of providing protection for workmen from revolving shafts is shown in the accompanying photograph. The installation pictured is a home-made sleeve fitted over the protruding end of the band wheel shaft on the back side of a large pumping unit in the Oklahoma City field. This sleeve was made from a piece of junk casing, it being larger in diameter by several inches than the shaft and cut to a length that exceeds the length of the shaft past the roller bearing housing by several inches also. The end of the pipe was then closed by welding a plate over it as shown. Small bolts are welded to the sleeve to which are fastened the angle iron braces shown. These braces are also bolted to the frame work of the unit to hold the sleeve rigid and keep it from rubbing on the revolving band wheel shaft.

Novel Fire Extinguisher Box

The use of fire extinguishers is almost universal and where they are located inside of warm buildings the hazard of freezing is low but when they are used in large warehouses or in other exposed places, it is desirable that they be kept warm. To accomplish this one company has built wooden boxes with two compartments and in the lower compartment installed an ordinary electric light. A window of clear glass is provided in the upper compartment and a round hole drilled through the door in the lower compartment and covered with a piece of red glass so the light as seen is red and may be quickly located from any portion of the building. The electric light will keep the fluid in the extinguisher from freezing in weather down to about zero.



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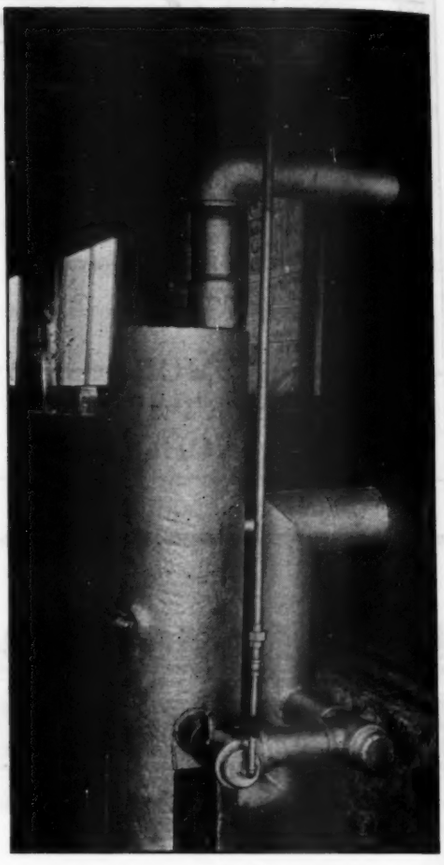
Gas Heaters Made From Old Casing Are Extensively Used in Oil Fields

By BEN E. LINDSLY*

Oil field development usually takes place in localities fairly remote from centers of population and supply. This condition, coupled with the usually high type of labor which the oil producing industry has always drawn to its ranks, has resulted in developing the creative instincts of the workers to adapt the materials at hand for their use. In many instances the large amount and variety of scrap or junk material, which in other places would be disposed of for its salvage value, is an incentive to creative genius, and it is safe to say that many of the most important improvements in oil field equipment and drilling practices were born on the derrick floor or in some obscure oil field shop rather than on the drafting table of an engineering concern.

This instinct to find new uses for old things extends beyond the oil field operations into the everyday life of the workers. For example, old drill bit cones develop an aesthetic value for their decorative effects on gate posts and as borders for gardens; pipe protectors outline sidewalks and driveways; junk pipe is converted into fence posts, cattle guards and playground apparatus for children; oil drums become effective shower bath tanks or garbage incinerators; and old casing is well adapted for the construction of gas heaters for "dog houses" and other oil field structures.



Gas heater installed in Bureau of Mines laboratory

These improvised gas heaters are of no particular size, type or style. They may be upright or horizontal and ordinarily vary from 6 to 15 inches in diameter and from 4 to 12 feet in length. Usually they are supported by legs made of smaller pipe and often are fair exhibitions of the welder's art.

From somewhat more than casual observation in a number of oil fields, the writer has noticed that the majority of these improvised heaters, although effective heat producers, burn with a loud roar or produce malodorous fumes, indicating improper design of the burner and mixing chamber.

In the present instance, the problem of designing a vapor-proof heater consisted essentially of confining the gas flame within the heater so that the air in the building by no possible means could have access to the flame through any crack or opening in the apparatus.

A safety, or vapor-proof heater, is highly essential in a laboratory where work on "bottom-hole" samples of oil and gas mixtures is being conducted. This fact is more readily appreciated when it is known that the laboratory procedure involves handling and transferring from one container to another oil-gas mixtures at pressures up to 3,000 pounds per square inch, and at temperatures up to 150° F. The rupture of some part of the apparatus or the inadvertent opening of a valve might easily fill the laboratory with an explosive air-gas-oil mixture, which would readily ignite if the ordinary type of gas heater were used. To preclude this possible source of danger, a heater was developed

(Continued on Page 39)

*Senior Petroleum Engineer, U. S. Bureau of Mines, Bartlesville, Okla., 1934. Since transferred to the Petroleum Administrative Board as Senior Petroleum Engineer and Chairman of the Technical Advisory Committee.

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THE TERMITE——

Is It a Real Menace?

By JOHN R. STINSON
Los Angeles, Calif.

A. P. I.—The oil industry has been a major consumer of wood. Damage from termites has been high and is increasing. This paper was presented before the regular January meeting of the Los Angeles Basin Chapter of the Division of Production and deals with the characteristics of termites and methods of control.

Approaching this subject not as an expert entomologist who calls the western subterranean termites Reticulitermes hesperus, the common drywood termite Kalotermes minor or the damp-wood termite of the western United States genus zootermopsis, but rather as a business man understanding English and with only a smattering of Latin, I am prompted to ask first, "What is a termite?"

May I here insert the definition given by a real estate broker in a recent examination when asked "What is a termite?" replied "An instrument which is set on the wall to indicate how cold or warm the room is."

Termites are commonly but erroneously called "white ants" or "flying ants." Not all species and castes are white and termites are not ants. While it is true that the vast majority of individuals in colonies of termites are white, these are seldom visible unless dug out of their burrows in wood or earth. The winged forms correctly called "alates" or the common name of "flying ants," have black bodies and long wings about twice the length of their bodies. These wings are transparent and usually white. The term "white ants" is misleading and should be abandoned as should the term "flying ants." The winged forms or reproductives are also commonly called "swarmers."

As a group, termites are very ancient. The ordinary cockroach is their nearest relative, but they have been distinct from each other for millions of years. Fossil remains of the very genus whose species are now doing tremendous damage all over the United States have been found in deposits known to be many millions of years old. They have lived for great periods of time on the wood furnished by forests, the main ingredient sought being cellulose.

Attack Many Substances

They have been known to attack furniture, clothing, shoes, books, paper, living vegetation, mummies, coffins in graves, bones, elephant tusks, ivory, human cadavers protected by formaldehyde, lead sheathing, rubber insulation, and lime mortar.

We are not facing, therefore, any invasion of new forces, as many have imagined, but simply an adjustment with species already present many millions of years before man entered the scene and began changing the conditions affecting the lives of termites. The termite problem arises because of man's attempts to change the ordinary processes of nature by preserving for his own use, over considerable periods of time, wood and its products, which it has been the immemorial function of the termite and associated organisms to break down and return to the soils and atmosphere.

The solution of the problem lies in man's interruption of the chain of events in the life history of the insect at some weak or accessible link, such as endeavoring to prevent or repell the invasion of the primary pair of reproductives, or attempts to poison out the colony. Without question the most effective and practical means of preventing termite damage and infestation to wood structures is to make the wood undesirable as food or inaccessible to their attacks.

The life cycle of the termite is extremely interesting. Naturally the beginning is the king and queen for reproduction, often replaced or supplemented by supplementary reproductives. From the eggs come the young nymphs, which as they grow older are divided into the supplementary reproductives, the workers, the soldiers, and reproductives or alates, that is, the winged males and females. And so the cycle continues.

The majority of individuals in the colony are workers and nymphs which are blind and weak and particularly helpless when exposed in their burrows. They cannot long survive the drying influence of heat and air currents, and die very quickly when removed from the moist, crowded conditions of their dwellings. The swarming forms, however, are typical insects with large black, compound eyes, long wings and hard pigmented outer skeleton. These winged termites or "alates" are the matured males and females, the potential kings and queens of new colonies. On alighting after swarming, they prepare again for the customary habit of life by breaking off their wings and assorting themselves in pairs. These swarming termites are the prey of lizards, birds, ants, and even of man in certain parts of the world. Those which succeed in pairing and escaping their enemies, eat they way into wood or dig into the earth and start new colonies.

The colony develops slowly the first year. In many species the queen becomes greatly swollen, due to the enlargement of the ovaries and post adult growth, increases gradually in egg-laying powers, and the colony increases in numbers, to millions in the case of some tropical species, many thousands in the case of our subterranean species and many hundreds in the case of wood-dwelling termites.

Termites are insects; therefore, have six legs. At all stages after hatching, the body is made up of segments arranged in three distinct regions; head, thorax, and abdomen. The head bears one pair of antennae or "feelers," and a pair of mandibles or jaws, and other complicated mouth parts. Kings and queens have black compound eyes. The thorax is made up of three segments, each of which bears one pair of legs. The wings of the alate stage are borne on the last two segments of the thorax. Most of the individuals of any species, however, are entirely wingless and without eyes or possessed with but vestiges of eyes. They live habitually in the dark and shun the light.

Termites fall into two major habitat types—wood-dwelling and earth-dwelling. The former confine themselves to wood with no connection whatsoever with the earth. There are two types—drywood (sound wood) and damp-wood (rotten wood). Earth dwelling termites are of several different types, such as subterranean, desert, mound-building, and carton-nest, but from an economical point of view the subterranean termites are by far the most important. They live in the earth and wood in contact with earth and feed upon wood placed in or upon the ground and from such wood as a center extend their attacks to wood removed from ground contact. In some cases they build shelter tubes or covered runways from their galleries in the ground over wood, plaster or cement, to wood at higher levels, even to the second floors and above of dwellings and higher floors in commercial buildings.

Habitats Variable

It will be seen that all types of termites live habitually in narrow galleries or passageways. These galleries may be entirely within the wood as in the case of wood-dwelling termites or in burrows in the earth, in the case of subterranean termites, connected with galleries in the wood upon which they feed. They are all thus protected from many of the accidents, exposures, and contacts characteristic of the life of many insects. Each colony is an isolated unit, almost impossible to locate and in the case of subterranean termites, usually located well below the frost line. The members of each colony are shut off from attacks by other insects and even from contacts with other colonies of the same species. They are thus able to live securely side by side with one of their deadliest enemies, the ant.

Termites are not ordinarily visible to man except at the swarming season. Their secretive instinct limits their life at all other times to their burrows in the earth, in natural vegetation or in wood products. Their burrows in the earth are small, not easily disclosed, pass undetected and can be found only by diligent inspection and great care. Their burrows in wood come to notice only when the dead parts of trees and the logs, poles, timbers of houses in which they live are open to inspection. Their devastations in the wood in which they are burrowing are often preceded by fungus attack and followed by the resulting dry rot and decay. Termite damage, except in its final stage, may therefore escape detection and after its completion be attributed to other causes to a misleading extent.

Upper—Termite infested floor sill
Lower—Books destroyed by termites

The social life of the termite is accompanied by a number of very marked instincts which together serve to maintain the colony. Among these are the recognition of the members of the colony by odor, and antagonism to members of other colonies, which leads at once to the destruction of the stranger. The grooming habits not only serve to remove dust, molds, and offending particles from one another, but also yield the much desired exudates from gland cells. The cooperation of different individuals in the construction and maintenance of their galleries, and the building of complicated nests, all call for the direction and coordination of efforts in the removal of wood and in the selection and placements of materials used.

A distinguishing feature of termite engineering is the retention of the protecting outer shell of the timber whose interior is being excavated for food. Termites seldom, if ever, pierce this except to permit the exit of alates or to remove pellets. All openings are promptly closed and breaches into the burrows walled off by new construction. Termite-invaded structures are rarely so completely riddled as to fall of their own weight. Sufficient wood is usually left to maintain the structure intact unless wrecked by external agents, such as earthquakes, storms, or the increase of burden carried, as occurred in an instance when a recently installed piano crashed through a termite-riddled floor and joints.

Exploratory Habits

The exploratory instinct of termites is shown in the construction of shelter tubes or covered runways over cement walls, through cracks in concrete or through porous concrete and tunnels through the earth for relatively long distances, apparently in search of new sources of wood supply or favorable exits for alates. This is further exemplified by the selection of particular boards or timbers among the many available on an infested structure.

Another instinct which is basic in the social habits of these insects is their almost ceaseless activity. They have never been observed to rest for any considerable length of time except when chilled or molting. And under normal conditions of moisture and temperature, the workers or nymphs toil ceaselessly in the various industries of the colony.

The keen sensitiveness of termites is remarkable, provided for by an elaborate system of tactile sensory hairs on all projecting parts of the body, and by a diverse group of specialized sense organs on the antennae and mouth parts. The biting jaws of the termites are densely and exquisitely innervated. Stimulation by touch, odor, taste, and pressure, guide the complicated reactions and instinctive behavior of the complicated social life. Indeed, the coordinated behavior seems at times to attain the higher levels of actions which may be designated as intelligent. The social life of the termites seems to have permitted the individual to benefit by experience, and to have raised the level of behavior in some of its aspects from instinct to intelligence.

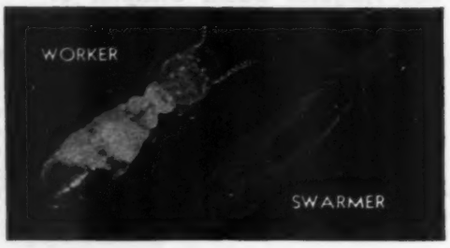
Maeterlinck in his "Life of the White Ant" admires them for their ability as engineers and as a perfect working and social organization. He says: "Their civilization, which is earliest of any, is the most curious, the most complex, the most intelligent, and in a sense the most logical and best fitted to the difficulties of existence which has appeared before our own on the earth. From several points of view this civilization, although fierce, sinister, and often repulsive, is superior to that of the bee, of the ant, and even of man himself."

Now, having built up the intelligence of the termite to a par with man himself, according to this authority, man is obliged to pit his intelligence against that of the termite in counteracting the damage already done, in preventing further damage where damage has already started, and in the exercise of insulation to prevent new damage.

Typical termite damage in wall studding of house

Naturally, a very pertinent question in connection with termite damage is "How much damage do they do?" While a conservative figure of $40,000,000 is given by the U. S. Bureau of Entomology, Department of Agriculture, as the annual damage in the United States, it is the consensus of opinion of many engaged in the profession of termite control, that this figure is low and several millions should be added to it.

Another question that follows is "How rapidly do they work?" That is not determinable. Instances have appeared where in three months' time termites caused damage costing $150 or more to repair. Another instance is known where they drilled 4 feet through an 8x8-inch timber in four months. An instance in Los Angeles is known where a beautiful home was heavily infested in nine months. Another instance of a house in Los Angeles is known where dry wood termites were in the walls from the sills to the top of the second story firewalls, all across the ground and second floors in both subfloor and finished floor, and across the building in the ceiling joists. In addition to this, there were under the building subterranean termites, beetles, and fungi. Please get this thought about termite damage thoroughly in your minds. When they attack a building they do not leave it, and while their damage may be slow in some instances, fast in others, in all cases, it is ever-increasing. They work under our beds while we sleep.



Two types of termites common to oil field

Termite tunnels on piers and foundation walls

Termites will attack anything that has cellulose in it. They work in wood over steel, glass, stone, brick, concrete—in fact over any building material. Many conditions, therefore, arise requiring protection from termites to stored materials as well as to buildings themselves.

And here is a question we often hear asked: "Has the situation been overemphasized?" An authority in St. Louis states that a survey of 3,000 buildings in that city revealed that over 2,100 were infested with termites and of these over 50 per cent required structural replacements. In a national survey of over 200,000 homes and buildings the Terminix Licensees of E. L. Bruce Co. found in excess of 50 per cent with termite infestation, many seriously damaged. I believe I am quite safe and conservative in the statement that 60 per cent of the buildings in Southern California are infested with termites to one degree or another.

All of you will agree that an article in the Saturday Evening Post must have real value. Please then refer to the November 2, 1935, issue and read "Some Very Social Insects." The subject must have readers interest. Why? Because the interest is economic. Again, please refer to the October, 1935, issue of "Residential Appraisers Review." In that issue is an article titled "Termites and Property Value" by C. Ellis Hunt. The article states:

"The ability of termites to destroy completely wood structures, and their spread in 47 of 48 states, has made them a factor which must be considered in appraising residential property for lending institutions. Because of its destructiveness appraisers as well as everyone interested in residential property must be on the lookout for this insect."

This would certainly seem to indicate that the damage of termites cannot be overemphasized—that such damage is certain and sure and in time quite expensive.

Right here I would like to leave two thoughts with you: First, if figuring on purchasing a building, I would say to you, "Investigate before you invest." Second, if you are the owner of a building or buildings, have them inspected twice a year by a thoroughly competent, trained and reliable inspector.

Suggested Protective Methods

What shall we do about the termite problem? Shall it be termite "insulation" or termite "eradication or extermination"? Are they the same thing? Indeed, no! Termite eradication or extermination is not even necessarily a complement to complete insulation from termite attacks but is usually associated with or a direct result of correct and thorough insulation.

First, let us consult the dictionary for definition of the three words, insulate, eradicate and exterminate. Insulate means to place in a detached position; to isolate; to separate by nonconductor; to prevent transfer. Eradicate means to destroy utterly. And exterminate means to annihilate, to root out.

Previously I have recounted for you considerable about the lives and habits of subterranean termites. Their nests or termitaria are located usually well beneath the surface of the ground, often very deeply embedded in the soil. They attack structures from these nests below the surface of the ground. Is it not then obvious that it is impossible to kill out, eradicate or exterminate the insects in as much as living entirely in the ground, it is impossible to locate such nests? And too, it should be recognized that ground penetration by even the most powerful and penetrative chemical is confined to a relatively few inches.

Due largely to the ignorance of the general public, and for want of more careful investigation, it is unfortunately possible to obtain all kinds and types of "termite eradication" for almost any price you wish to pay. Particular care, however, should be exercised by owners to see that safe and result-producing chemicals only are used. Two of the commonest in use are sodium arsenate and creosote. Of arsenic, Dr. C. A. Kofoid, University

of California, in a radio talk December 4, 1934, spoke as follows:

"Investigations have shown that all three kinds of termites are generally associated with certain fungi which have the uncanny faculty of using arsenic in feeding, without being killed, in such a way that the highly volatile and very poisonous arsine gas is liberated from arsenic used in treating the soil or in chemically treating wood and wallboard as a termite preventive. The Termite Investigations Committee is therefore strongly recommending against the use of arsenic in any form whatever in building materials, wallboards and under and around buildings as a termite preventive. The reason for the recommendation is the arsenic hazard in fires and the potential danger of the production by fungi introduced by termites, of the human body to a toxic or lethal dose by continued inhalation of the arsine."

Of creosote, I quote from letters from creosote manufacturers:

One says: "We regard efforts to prevent termite damage by painting with creosote as practically a waste of time. In brushing with creosote, penetration rarely exceeds one-eighth to a quarter of an inch, leaving the larger parts of the timbers untreated and unprotected against termites."

Another says: "The method you propose to use will not protect homes from termite damage. Painting the surface with creosote oil accomplishes little, if any, good since termites will work through the interior of the wood and where the surface application does not penetrate."

Let me urge you not to confuse correct insulation with sprays, powders, chemicals, and so-called termite "exterminators" and "eradicators." It is, and rightly should be, an indisputable fact that eradication or extermination of all subterranean termites in, around or underneath a building by means of a direct killing agent is obviously unaccomplishable due to the physical impossibility of being able to see and locate the hidden nests or terminaria, usually well-hidden shelter tubes or covered runways which these craftiest of insects construct for their own protection.

Correct insulation work in reality begins where such methods of eradication leave off. Recognizing the difficulties involved in assuring lasting protection, the chemical formula, the equipment designed for its use and the training of competent operators, should be devoted properly to impregnation and insulation. This is effectively accomplished by three lines of defense laid down against termite attack. First, actual killing and soil inoculation at the first line of attack; second, pressure-treating and blocking off all contact points in foundation walls and supports. Third, and most important of all, high-pressure injection and impregnation of all understructure wood members at their bearing points on all supporting construction.

In order to assure this protection, it is necessary that the chemical formula contain a permanent toxicant poisonous to termites but not to human beings or animals, and which toxicant will remain indefinitely wherever the liquid has penetrated. This toxic film is the true barrier to termites.

Thus, the principle of correct insulation is that of protection to the structure itself, rendering it immune to further attack. The results of correct insulation should be:

1. Chemically placing a shield between the structure and the ground from which the subterranean termites attack.

2. Shutting off termites in the structure from recontacting the ground, resulting in the death of those termites existent in the structure of shutting off their supply of moisture and contacts with their nests, both of which are indispensable to subterranean termites.

3. Preventing those termites in the ground from going up to attack the structure for food.

4. Rendering completely toxic the entire untire understructures of the house or building. Termites remaining in the ground are thus held off within the ground, driven off to other feeding

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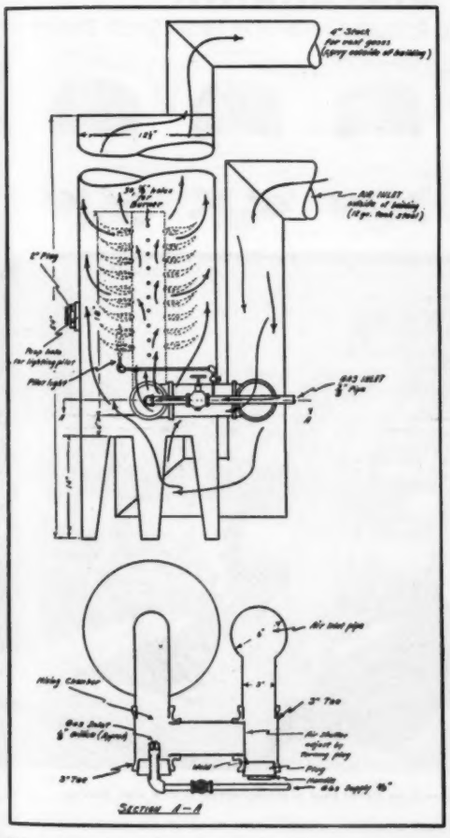
grounds or starved off by thus removing their source of food supply, or finally being killed by attempting to penetrate this toxic shield or to eat poisoned food supply.

Thus you can readily see, the work of effectively protecting structures from termite attacks is not a problem of simply spraying, brush coating or fumigating the understructure of the building. But to the contrary, such complete chemical insulation is a highly technical and scientific method of termite control, proven to be effective and economical. It requires, as I have said, first a lastingly effective chemical; second, specially developed treating appliances, and third, thoroughly trained and experienced operators; and, fourth, a carefully followed up system of reinspections over a period of years. In addition to these, and of paramount importance, the person or organization doing the insulation work should be thoroughly responsible ethically and financially. It is up to the owner to "investigate before he invests" to avoid the "fly-by-night" and the obvious racketeer.

Gas Heaters Made from Casing Extensively Used in Fields

(Continued from Page 34)

with the burner entirely inclosed within a piece of 12-inch casing and supplied with air from outside the building by means of a pipe which extended through the wall. Since the flue gas was conducted through the roof by a 4-inch pipe it was impossible for the heating stove to ignite an explosive air-gas mixture that might through some



Working drawing of vapor-tight gas heater

mishap be introduced into the room, provided the shell of the heater was kept below the ignition temperature of the gas mixture.

The heater in question had its initial development at Kilgore, Tex., during the winter of 1932-1933, in a laboratory built by a number of producing companies who cooperated financially in furthering the Bureau of Mines studies of reservoir and well conditions in the East Texas field. Although this heater assured absolute safety and gave out an ample amount of heat, its burner and air mixer were not well proportioned, and accord-

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ingly improvements in design have been made. The improved type of heater shown in the accompanying sketch was installed in the laboratory built for "bottom-hole" studies by Bureau of Mines engineers in the Oklahoma City field in 1933-1934.

The burner as shown in sketch consists essentially of a piece of 3-inch pipe about 18 inches long, and drilled with 30 three-eighths inch holes. The mixing chamber consists of a 3-inch tee, and the gas jet or orifice tip is a Zerk grease-gun fitting having one-eighth inch pipe thread on one end and a small orifice at the other. The orifice tip should be reamed out to a diameter varying between three-thirty-seconds and five-thirty-seconds inch, according to the gas pressure, draft and other conditions.

The three-eighths inch gas line enters the end opening of the 3-inch tee through a 3-inch plug drilled and threaded for three-eighths inch pipe. Instead of using 3-inch valve to regulate the amount of air entering the burner, an air shutter was made by welding a piece of light sheet metal onto a 3-inch plug. This is screwed into the end of a second 3-inch tee, which is one of the fittings connecting the main air inlet line with the mixing chamber. A half turn of the plug completely covers the side opening of the second tee and prevents the passage of air to the burner. The adjustment of this shutter is simple. An important feature is the 6-inch pipe (made up from 12-gauge tank steel) which runs from outside the building and connects with the base of the heater. This supplies auxiliary air without which a burner operating at atmospheric pressure would be unable to obtain the required 10 or more volumes of air per volume of gas necessary for complete combustion.

After a month's operation it was evident that the design could be improved considerably by equipping the heater with a pilot light because it was found that lighting with a piece of paper twisted into the form of a small torch was difficult when the wind was in certain directions. Once in operation, however, the direction or intensity of the wind made no difference in the effectiveness of the heater. Although no pilot light was ever installed on the heaters at the Oklahoma City field laboratory, one is shown on the accompanying sketch because of the added safety which it would afford to those who might build similar heaters. In operation it should always be remembered that the safety features of the heater lose their effectiveness if the 2-inch plug is not inserted tightly in the peephole at all times when the heater is in operation.

Although the heater was designed especially for laboratory use, where oil and gas are being tested at high pressure, it can serve equally well as a garage heater or in rooms where acetylene generators are kept, in automobile paint shops where highly inflammable lacquers are sprayed through spray guns, and, in fact, in any place where gas or vapors from highly volatile liquids might escape in considerable quantity in the air.

Among those who aided in the development of this heater are: Gene Doyle, shop superintendent, Shell Petroleum Corp., Kilgore, Tex., and M. M. Frit, L. C. McGill and Pete Weber, Phillips Petroleum Co., Oklahoma City, Okla.

Lone Star and Community Gas Rate Inquiry Reopened

The Oklahoma Corporation Commission has ordered a reopening of a general investigation of the rates of the Lone Star Gas Co. and its subsidiary, Community Natural Gas Co. A hearing was set for March 24.

In a temporary order the commission ordered a reduction of 10 cents a thousand feet in the gate rate and at burner tips. The Supreme Court in effect sustained the reduction of the gate rate but not the reduction at burner tips.

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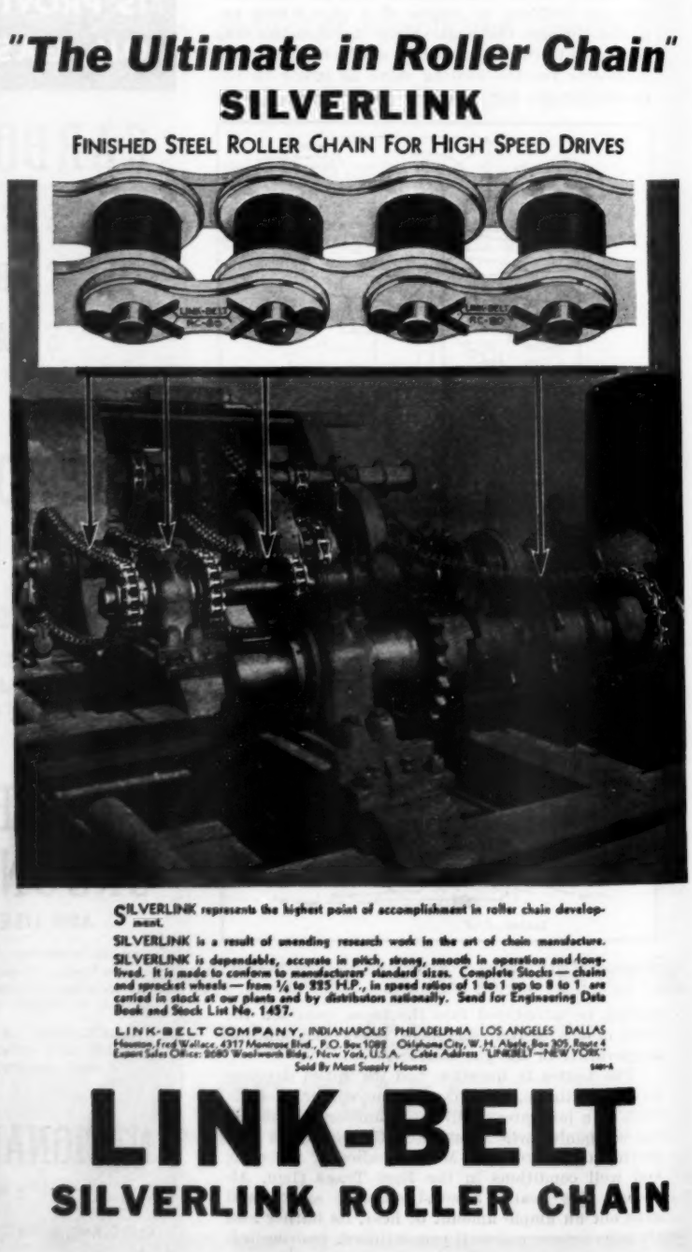
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DISPOSAL OF PRODUCTION WASTES:

Underground Disposal of Salt Water

By MARVIN LEE
Geologist, Secretary and Technical Adviser to State Corporation Commission, Wichita, Kans.

A. P. I.—Measures taken by oil companies in Kansas to dispose of salt water and production wastes are discussed by the author in a paper delivered before the Wichita meeting of the Mid-Continent Section of the American Petroleum Institute.

Any constructive action for the disposal of oil field waste, for increasing oil recovery or for the prevention and abatement of contamination of fresh water, is of mutual interest to the oil industry and the public. The public or individuals that may be favorably or unfavorably affected, when considered in present and future terms, extends to a great number of persons and involves immense sums of capital. Unnecessary expense forced onto the industry ultimately affects the bills of the consumer and retards capital investment and development.

The public has a great common interest in continuity of the petroleum industry's exploration, development, transportation, refining and marketing, to supply products necessary to the nation's civilized existence at reasonable cost.

The immensity of the problem of operating the petroleum industry, with the minimum of waste and damage and the maximum of service, is worthy of the careful study of all leaders in the industry and government.

In its search for new reserves, the petroleum industry is the most aggressive and roving of all American natural resource industries. It conducts its work from the oceans to the mountains, at all seasons, meeting a multitude of operating conditions seldom known to the general public.

Oil Industry Investment

The petroleum industry is reported to have over $12,000,000,000 invested in its many activities, exclusive of more than $2,000,000,000 additional capital used in the natural-gas operations, which is a part of it, although usually considered as a companion industry. It provides employment for approximately 1,500,000 people, of which more than half are engaged in retail sales; about 115,000 are employed in producing; nearly the same number in refining and 20,000 to 25,000 operate the pipe line systems.

It is impossible for such a giant, as this industry has become in 75 years, to grow as it has and continue to expand as it must, without causing some damage. The producing, pipe line and refining branches are the causes of most of the contamination of fresh water resources.

Any national oil field waste disposal problem is of no greater interest, except for its size, than the state or local situation. If many small areas had never become damaging there would have been no necessary corrective laws.

Waste of oil, onto leases of others, has been an evil of long standing. Opinions are formed largely from observation of surface conditions. Some producers get condemned for contamination of streams that are in the same condition of pollution when entering as when leaving their property. It is rarely necessary to burn oil waste, but is better than to allow its wasting to damage others. Loss to a producer, by not making a profit from production, is bad, but paying for the bad operation of others is not endurable. Producers should consider both waste of oil on the ground and the black smoke of burning oil as black records against good management.

Cooperative efforts and better mutual understanding will always assist in corrective action for improvement of this permanent oil field condition, preventing much of the avoidable contamination or destruction of useful fresh water and promoting better public relations.

State agencies and industry are united in the educational and conservation work, which brings encouraging results.

Kansas Field Conditions

The fresh water conservation in Kansas became most acute and necessary, for oil field uses and for domestic and other purposes, during the 1934-35 drought periods, and resulted in unusual cooperation of producers in many communities by loaning equipment and otherwise sharing or providing available fresh water for many people.

Various state agencies were called upon, to the limit of their capacity, to quickly provide fresh water supplies to meet the emergencies.

The Kansas Emergency Relief Committee made an extensive statewide study, during the drought period, to provide ways and means of securing water for the immediate emergencies and to perpetuate the supply. Many wells were deepened,

TABLE 1—UNDERGROUND SALT WATER DISPOSAL PROJECTS UNDER OPERATION IN KANSAS

	Wells prod. water	Bbls. water per day
SEDGWICK COUNTY		
Greenwich field:		
Shell Petroleum Corp., No. 1-A P. F. Lagrisse, SE NE sec. 15-26-2e	26	10,000
ELK COUNTY		
Grand Summit field:		
Murphy Oil Co., No. 1 John T. Murphy, sec. 3-31-8e	4	60
BARTON COUNTY		
Ellinwood field:		
Stanolind Oil & Gas Co., No. 1 J. F. Herter, E½ sec. 17-20-11w	8	50
RICE COUNTY		
Chase field:		
Empire Oil & Refining Co., No. 3 R. P. Proffit, SE sec. 6-20-9w	8	50
Empire Oil & Refining Co., No. 1 M. Malone, S½ NW sec. 19-20-9w	10	1,800
RUSSELL COUNTY		
Neidenthal field:		
Gypsy Oil Co., No. 1-A M. Neidenthal, SE sec. 14-14-15w	3	1,500
The Texas Co., No. 1 M. Neidenthal, S½ NE sec. 23-14-15w	3	1,500
Phillips Petroleum Co., No. 1-A Holland, S½ SW sec. 13-14-15w	4	2,500
Phillips Petroleum Co., No. 1-A R. F. Wineteer, SE sec. 19-13-14w	3	1,500
Hall field:		
Skelly Oil Co., No. 1 Wilbur Opdyche, secs. 29 and 32-14-13w	1	50
Russell field:		
Empire Oil & Refining Co., No. 4 Ehrlick, SE sec. 28-13-14w	3	2,000
RENO COUNTY		
Burrton field:		
Marathon Oil Co., No. 1 S. E. Vansickle, NW sec. 23-23-4w	5	200
Olson Oil Co., Disp. Well, M. B. Blake, SW sec. 23-23-4w	9	2,000
Olson Oil Co., Disp. Well, E. R. Downie, NE sec. 14-23-4w	9	1,500
Olson Oil Co., Disp. Well, E. Krehbiel A, NW sec. 26-23-4w	8	700
Olson Oil Co., Disp. Well, F. Duckworth, NE sec. 23-23-4w	6	800
Olson Oil Co., Disp. Well, P. C. Roberts, W½ sec. 25-23-4w	5	900
Olson Oil Co., Disp. Well, J. H. Goerling B, NW sec. 35-23-4w	7	2,000
Olson Oil Co., Disp. Well, No. 1 E. J. England, W½ SE sec. 34-23-4w	5	500
Olson Oil Co., Disp. Well, No. 2 E. J. England, W½ sec. 34-23-4w	5	1,000
Gypsy Oil Co., No. 1-A Lena Krehbiel, NE sec. 35-23-4w	6	525
Gypsy Oil Co., No. 1 John Meyers, NW sec. 3-24-4w	5	1,500
Barnsdall Oil Co., Disp. Well, C. Baughman, E½ NE sec. 34-23-4w	3	1,000
Barnsdall Oil Co., No. 13 Martha Sabin "C," SE sec. 35-23-4w	13	3,000
T. M. Deal Oil & Gas Co., No. 23 McElwain, E half SE sec. 34-23-4w	5	1,250
H. F. Wilcox Oil & Gas Co., No. 3 F. F. Neufeldt, S½ NW sec. 12-23-4w	2	1,000
Amerada Petroleum Corp., Disp. Well, No. 1 H. Wilson, W½ SW sec. 23-23-4w	4	800
Sinclair Prairie Oil Co., Disp. Well, No. 1 G. M. Harner, SW sec. 14-23-4w	4	1,000
Stone field:		
Shell Petroleum Corp., No. 1 J. H. Flory, S½ SE sec. 9-24-4w	5	100
RICE COUNTY		
Chase field:		
Empire Oil & Refining Co., No. 4 Meyers, S½ SW sec. 21-19-9w	11	500
Phillips Petroleum Co., No. 6 H. Link, N½ sec. 21-19-9w	8	1,500
Neidenthal field:		
Lario Oil & Gas Co., SW No. 1 J. P. Boxberger, N½ NW sec. 34-14-15w	2	800
Galt field:		
Continental Oil Co., No. 1 E. F. Sherman, NW sec. 8-18-7w	1	100
BUTLER COUNTY		
Eldorado field:		
Empire Oil & Refining Co., No. 61 Enyart, W½ and NW NE sec. 12-26-4e	28	2,700
W. O. James, No. 5 Harmon, N½ SE SE sec. 24-26-4e	4	250
Sinclair Prairie, No. 64 J. B. Adams, SE sec. 31-25-5e	12	4,000
ELLSWORTH COUNTY		
Stoltenberg field:		
Derby Oil Co., No. 2 Stoltenberg, W¼ NW sec. 22-16-10w	2	1,000

Editor's Note: The above 37 projects are an abridged table of the original tabulations presented by the author.

new wells drilled and dams constructed to prevent possible future shortage.

Immensely valuable as the resources of the oil and gas are to Kansas, it became apparent that fresh water was even more necessary for the existence of some communities than their greatest possible income from the development of oil or gas.

The prevention of surface, well and stream pollution from any cause is recognized as most acutely necessary in western Kansas. This is because of the lighter annual rainfall, the limited zones of available fresh or usable water supply and the conditions of soil and stream beds which are extremely porous and permeable, permitting the infiltering brines or other pollution to more rapidly spread than where tight shale beds exist to retard the travel of damaging pollution.

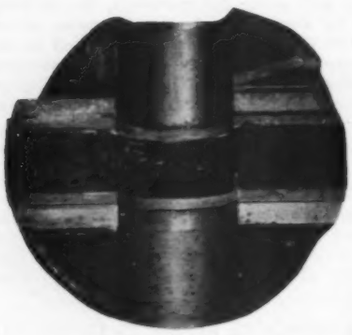
The enactment of legislation[2, 3] permitting underground disposal of salt water and repressuring with water or other liquid marked the beginning of a long delayed, but welcome aid to Kansas oil producers. It opened the way for both the legal and practical disposal of salt water without damage to fresh water resources and also for using salt water to increase production.

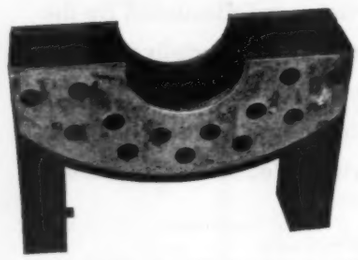
The State Corporation Commission was given the responsibility for promulgation of rules and regulations, and the administration of these laws, enacted for the dual purpose of production conservation and to provide ways and means of the disposal of oil field brines without damage to fresh water resources. Many waste problems of producers have been brought to the attention of the commission. The matter of water disposal and repressuring are directly a part of oil and gas production and operating expense. The first rules, pertaining to these operations, and suggestions of producers were carefully considered, and a revision was recently issued[4, 5] to promote the better administration of the laws and easier compliance of the producers in making applications to the commission for orders as required by statute.

The law[2] permits rules and regulations to be made for air or gas repressuring. To date air or gas repressuring are not being handled under specific rules, but considered upon individual application.

[2]Disposal of Salt Water, Chapter 211, Session Laws, 1935.

[3]To Regulate the Repressuring and Water Flooding of Oil and Gas Properties, Chapter 212, Session Laws, 1935.





Unretouched photographs above were taken following the test herein described. Despite wear of approximately ¼-inch on the face of the packing opposed to the drill pipe, the Cameron Preventer maintained a pressure-tight seal throughout the test.

HOUR *after* HOUR—

wear was automatically taken up by Self-feeding ram packing element

For years, operators have needed a blowout preventer through which, when closed, drill pipe could be rotated and spudded safely to prevent sticking while circulating to gain control over a kicking well.

Due to the perfection of a new self-feeding ram packing element, Cameron Iron Works is now able to furnish such a preventer—in either pressure operated or manually operated types.

On a recent "wear-down" test to determine how much punishment the new ram packing could absorb without leaking, a 13⅝" Type "SDA" Pressure Operated Cameron Preventer was installed on a well in which 2200 feet of casing had been cemented. With 1900 feet of drill pipe in the hole, rams of the Preventer were closed and 1000-lb. casing pressure built up with the slush pumps.

Drill pipe was then rotated between 10 and 70 R.P.M., and raised and lowered between tool joints every so often. Hour after hour, wear was automatically taken up by the new self-feeding ram packing element. No leaks occurred at any time. Following the test, ram packing elements were examined and showed wear of approximately ¼-inch on the concave face opposed to the pipe. Notwithstanding this loss of packing material, the rams held a pressure tight seal throughout the long test.

The rams were then brought to the Houston shops of the Cameron Iron Works, Inc., and installed in a preventer on the test block. The worn ram packing elements were left in them. The rams held 3,000-lb. casing pressure easily, without sign of a leak. On a squeeze test, in which the rams were closed by pressure with no pipe between them, sufficient resilient packing material remained, and was forced out between the packing retainer plates, to form a circle having an I.D. of 3⅝" in a normal bore of 4½"—indicating there remained almost twice as much packing in reserve as had been worn off.

Operators who recognize the importance of rotating and spudding while circulating under pressure, should obtain full information about this latest development in blowout prevention. Full details will gladly be furnished on request.

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Underground Disposal of Salt Water

The primary problem of producers, in underground disposal, has been to meet the requirements of the law[2] by introducing salt water into formations not producing oil or gas and to prevent such disposal either damaging production in the field or the fresh water, at higher levels in the wells.

In connection with underground disposal, cooperative work has been done by the State Board of Health, as is explained by R. C. Mitchell,[6] and considerable research work has been done by the U. S. Bureau of Mines, with the cooperation of several producers, to ascertain the best procedure. Water treatment is sometimes necessary to secure the most effective results. Under all of the several commission orders issued, which are listed for reference,[7] no case has been reported where the procedure has caused any damage to oil or gas production or fresh water resources. A study of the location of these wells shows that most of them are in the western Kansas fields. Conferences between disposal well owners result in exchange of valuable ideas as developed by this rather new experimental work. Two applications for underground disposal (which should have been filed for repressuring) and one application for underground disposal, on account of equipment procedure, have met with objection; preventing order issuance under original applications. While this may be considered an unusual record, it is due to the cooperation and care exercised by producers and to supplying the commission with the necessary facts before disposal orders were issued.

Underground disposal, wherever it is possible, offers the permanent method of eliminating many annoyances and damages caused by past methods of attempted disposal.

Underground disposal cannot always be easily made on account of not having available wells, with formations of sufficient porosity and permeability, that are nonproductive of oil or fresh water, into which salt water may be introduced for disposal purposes.

Salt water disposal is becoming recognized as just as much a necessary part of producing expense as lifting costs and other operations. Future drilling, in many instances, will be done with underground salt water disposal considered and planned in advance of its actual necessity. Community operation of disposal projects will become more frequently used. Dry holes, drilled during the course of field development, will become a source of value for disposal purposes that are so greatly needed in the later life of the fields.

More research work is being done by the engineering departments of companies and with the aid of state and federal agencies, it seems certain that improved methods will eliminate great quantities of salt water from stream pollution or otherwise damaging local fresh water supplies. Cooperative disposal plans will greatly reduce disposal costs.

Operating Problems

The chemical content of the different brines also varies widely in amount of other minerals than sodium-chloride. Salt is the most frequently discussed of the water contaminating minerals. Some waters are not so salty as others, but the public's ideas are not discriminating as to the degree of damage salt water may cause. With some waters, it appears necessary to prevent the brine coming in contact with oxygen on the surface and to handle it in a closed circuit from the producing well back to the disposal well. Some brines may require filtering or other chemical treatment to prevent chemical reaction that tends

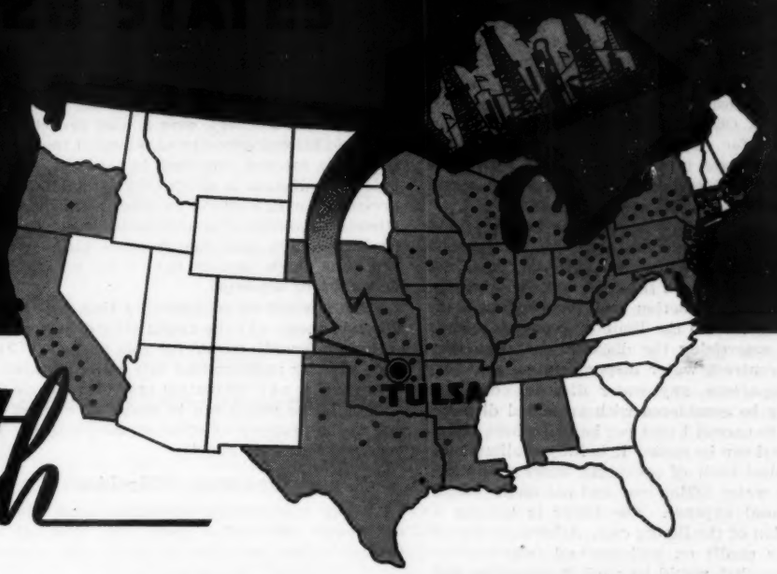
[4]Disposal of Salt Water, State Corporation Commission, Order No. 36-01-22.

[5]Repressuring and Flooding, State Corporation Commission, Order No. 36-01-22.

[6]Conservation of Fresh Water, by R. C. Mitchell, Research Engineer, State Board of Health.

[7]Table No. 1, Underground Salt Water Disposal.

A TEN MILLION DOLLAR SHOW



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to clog or seal the pore space of the disposal formation. The tendency of most producers is to separate the brines in surface ponds or tanks, remove any oil or basic sediment which is frequently the most damaging factor in clogging disposal formations, then return the water by gravity or pump pressure into the disposal wells.

Cost of Disposal

On accountof the newness of the procedure, it is not possible at this time to give details as to cost and difficulties encountered.

Low income from some production frequently prevents added expense of drilling additional wells for disposal purposes. When it is prohibitive from the economic standpoint, it is sometimes more advantageous to pay for local damage caused.

Some producers consider noncorrosive pipe economical in disposal wells, especially for long operating periods. Charging of costs to separate leases of the field, for cooperative or other cost distribution, requires the measurement of the water, for quantity-charge determination, by tank measurement, metering or other accurate methods.

The balance of profit or loss may be considered as related to the contract price, that might be secured or paid for salt water disposal. This depends on the reserves in the field and the oil-water ratio of future production and the combined oil-water lifting cost to the limit of economic operation while amortizing the disposal operation cost or paying contract water disposal rates.

For comparison, any water disposal condition may usually be considered with an added disposal cost of not to exceed 1 cent per barrel, where group lease disposal can be made. It is fully realized that the economical limit of operating water producing wells is the water lifting cost and not underground water disposal expense. The latter is usually a small fraction of the lifting cost. Allowance should be given as credit on underground disposal, for money saved that would be paid in litigation and damages, as well as net increased total recovery from prolonged operation of the lease.

In the assembly of disposal operations being conducted, columns are left for the estimated cost of drilling and equipping disposal wells and for the noting of difficulties reported. These are two very important items, considered by engineers in reporting underground disposal possibilities to their companies, but are not requirements made by the State Corporation Commission. The interchange of cost figures between the persons operating either disposal or repressuring wells will furnish cost items to be inserted in these columns for convenient future reference.

Repressuring and Flooding

The law[1] permitting repressuring or flooding with water or other fluid states that it is to be "for the purpose of recovering the oil and gas contained therein," Commission rules issued apply to the introduction of any liquid or for repressuring with salt or fresh water only into producing formations.

In repressuring it has frequently been found that the introduction of a small amount of water into a producing formation, especially in greatly depleted fields, is not damaging. It is also not very helpful in immediately increasing the recovery, but acts as a satisfactory method of brine disposal by introducing it into a formation that takes the water with least resistance. Water repressuring should be started slowly and its results carefully recorded. Several years of valuable experience of Pennsylvania producers has proven the worth of water flooding or repressuring of old fields.

Several repressuring orders[2] have been issued that meet the technical legal requirements of repressuring, but the primary purpose of such repressuring has been for salt water disposal purposes. Some have resulted in checking the decline of the production, which may be considered as also increasing the recovery.

Since repressuring frequently accomplishes results for brine disposal and increasing recovery, it is expected that this method will become increasingly used, especially in the older fields, and that the small amount of water now being introduced may be found to be of sufficient value that the addition of greater quantities of salt water or fresh water, when obtainable, will also be used. Some producers have secured additional supplies of fresh water from streams and ponds, and also have drilled wells to obtain salt water for repressuring purposes.

The details of each operation, including the source of water supply, have been stated in each order issued for repressuring.

Recovery Possibilities

Various engineering estimates have been made as to the amount of recoverable oil that exists in the producing formations of the older fields. While these estimates are variable, it is generally conceded that usually less than and rarely not more than 30 per cent of the oil has been removed from producing formations and that the possibilities exist for the recovery, over a long period of time, of an additional quantity of oil equal to or greater than the amount obtained by ordinary methods before production is artificially stimulated, by repressuring with water or by other methods. Greater stimulated recovery is anticipated from the fields producing from sand than from the lime reservoirs. The lime fields usually have some natural water drive before depletion.

The amount of repressuring that will be done depends upon: (1) the availability of water (fresh water preferred) usable for this purpose; (2) the necessity for underground salt water disposal and repressuring as combination projects; (3) the location of leases which can be operated without damage to the property of other producers in the same common source of supply.

Operating Difficulties

Water repressuring operations have the same or greater difficulties than brine disposal only, because of the necessity of using more expensive equipment, especially increased cementing of casing and necessary precautions, to protect other producing formations in the field. The same precautions, as for disposal, are required to keep the water in condition to travel freely through the producing formation.

Of the several repressuring operations now authorized in Kansas, no instance has been called to the commission of the procedure damaging any producer. With the care and caution being exercised, it is believed that these repressuring operations can be planned, by careful engineering study, so that many fields will be able to continue to produce oil for many years at a sufficient rate to justify their continued operation at the present price and proportionately longer at anticipated higher oil prices.

Repressuring Expense

The expense, necessary to conduct repressuring on an extensive scale for oil recovery only, runs into large figures, the highest reported being about $3,000 per acre, which is considered very high. Some producers consider that the conservation of oil by the operation of properties to their ultimate economic recovery will justify expense equal to the cost of new leases, drilling and equipment to secure comparative amounts of oil. Future prices of production may justify greater repressuring expenditures than permitted by the present economic situation. All of these factors appear to be working toward the greater increase in repressuring with water, higher recovery of oil per acre and the further elimination of the objectionable brine disposal problems. It is certain that there will be disappointments and some projects will be abandoned as unprofitable, but that out of all of this work and experimentation there will result ways and means of doing a better job for oil conservation and waste disposal to the benefit of all persons interested.

TABLE 2—KANSAS REPRESSURING PROJECTS USING WATER OR OTHER LIQUIDS

	Wells or source of rep. liquid	Bbls. per day
MONTGOMERY COUNTY		
Wayside field:		
O. C. Boop, Rep. Well, Taylor, S½ SE sec. 28-33-14e	11	100
Ross Oil & Gas Co. et al, Rep. Well, Black, Brownlee & Taylor, Pt. secs. 27, 28 and 34-33-14e	11	100
CHAUTAUQUA COUNTY		
Sedan field:		
Denman Brothers, No. 69 Allbright fee, Pt. secs. 15 and 16-34-11e	1	50
Sinclair Prairie, Nos. 1 and 8 Madge Sipple, N½ NW sec. 22-34-11e	7	50
Sinclair Prairie, No. 22 R. J. Fulton, SE¼ and W½ NE sec. 26-33-12e	16	25
Sinclair Prairie, No. 6 White & Tows, S½ SE sec. 26-33-11e	8	25
Sinclair Prairie, No. 6 W. E. Wintermute, SW sec. 34-33-11e	6	25
Sinclair Prairie, No. 12 Chas. Casement, N½ SW and SW SW sec. 33-33-11e	9	25
Sinclair Prairie, No. 6 W. Johnson, NE NE sec. 22-34-11e	3	25
Sinclair Prairie, No. 8 Henry Gardner, S½ NE and N½ SE sec. 26-33-11e	12	25
Sinclair Prairie, Nos. 8, 12, 14 and 26 S. Huffman, Pt. secs. 14, 15 and 22-34-11e	14	25 per well
Sinclair Prairie, No. 6 A. Casement, Pt. sec. 32-33-11e	24	25
Sinclair Prairie, No. 70 J. Gregg, Pt. secs. 14, 21, 23, 26, 27 and 28; All secs. 15 and 22-33-11e	19	25
Sinclair Prairie, No. 21 Link Casement, NE sec. 5-34-11e and SE SE sec. 32-33-11e	21	25
Peru field:		
Sinclair Prairie, No. 7, S½ NW¼, SW and SE SE sec. 30, and W½ NW sec. 31-34-12e	16	20
Sinclair Prairie, No. 8 Geo. Bowen, S½ NE and N½ N½ SE sec. 19-34-12e	5	25
Sinclair Prairie, No. 1 Peru Berry, SE sec. 31-33-12e	10	25
Sinclair Prairie, Nos. 3 and 5 G. W. Swallow, S½ NE and N½ SE sec. 6-34-12e	6	25
Sinclair Prairie, No. 1 L. J. Cleek, Pt. sec. 30 and 31-34-12e	6	25
Sinclair Prairie, No. 16 Eliz. Winchell, Pt. secs. 16, 20, 21 and 29-34-12e	5	25
Deer Creek field:		
H. R. Harshbarger, Nos. 4 and 5 Harshbarger, NW sec. 3-34-11e	Upper sand	100
GREENWOOD COUNTY		
Seeley field:		
York State Oil Co., No. C1W C. E. Demalorie "C," NW sec. 32-22-11e	Surface pond	100
Scott field:		
Empire Oil & Refining Co., No. 9 Mary A. Scott, SE sec. 24-23-8e	8	40
Empire Oil & Refining Co., No. 2 J. J. Morris, N½ sec. 19-23-9e	4	20
Magnolia Petroleum Co., No. 1 J. J. Morris, W½ SE sec. 19-23-9e	6	30
Madison field:		
Empire Oil & Refining Co., No. 17 Duby, SW sec. 14 and NW sec. 23-22-11e	19	200
Edwards field:		
Phillips Petroleum Co., No. 9 W. H. Edwards, SE sec. 13-23-10e	18	50
ELK COUNTY		
Hanna field:		
Sinclair Prairie, No. 6 J. H. Porter, sec. 13-29-8e	14	150
Empire Oil & Refining Co., No. 6 Porter, NW sec. 13-29-8e	3	125
McPHERSON COUNTY		
Rits field:		
Phillips Petroleum Co., No. 2 A. M. Wiles, E½ NE sec. 25-19-2w	20	1,000
BUTLER COUNTY		
Eldorado field:		
Empire Oil & Refining Co., No. 58 Paulson, sec. 2-26-4e	40	3,000
LINN COUNTY		
Centerville Shoestring field:		
The Texas Co., No. 1-W D. Mundell, Pt. secs. 13 and 14-21-22e	Creek water	100
SUMNER COUNTY		
Oxford field:		
Shell Petroleum Corp., No. 1 Spence, Tract No. 3, NE sec. 14-32-2e	24	4,000

Editor's Note: The above 33 projects are listed as an abridged form of the table used by the author.

[1] Table No. 2, Repressuring With Water or Other Liquids.

QUESTIONS ON TECHNOLOGY

By Charles K. Francis, Ph.D., Technical Editor

Those connected with the refining of crude petroleum, the manufacture of natural gasoline and closely allied industries are invited to submit problems to Dr. C. K. Francis. Questions should give as much detail as possible. Inquiries must be signed but only the given initials will be printed. The source of questions is considered confidential. Questions requiring discussion of patents, the use of intricate formulas, extended computations, or cost estimates cannot be considered in these columns.

Metallizing Surfaces to Reduce Sulfur Corrosion in Refineries

What metal is it that is used for spraying on the inside of towers and chambers for preventing corrosion? Are coverings of this kind a permanent protection against sulfur corrosion?—A. L. G.

There are several metal coverings that are in use for reducing the corrosive action of sulfur in refinery units. The subject was discussed by R. E. Kunkler in World Petroleum 6, 528, 1935, and the following extracts from this article seem to answer the questions.

Aluminum or any metal drawn into wire form may be sprayed on to a metal surface as a protective coating from an apparatus that is like a welding torch combined with a paint spray gun.

A refinery in the northwest operates on Sunburst crude oil, which has high hydrogen sulfide content. The dome of a new reaction chamber lost three-sixteenths of an inch in wall thickness in nine months' use and corrosion had been excessive in the flash chamber. It was estimated that the chambers, which had cost $32,000, would not last more than eight years, and operating pressures would have to be reduced, so reducing operating efficiency. The two chambers were lined with 0.015—0.020 inch of aluminum at a cost of $500. A year later the coating was found to be in perfect condition, a complete check to further corrosion. Observations on the interior of a Mid-Continent Dubbs coking chamber that was metallized several years ago showed that the coating had not been damaged by the use of a pick to dislodge the coke. Even when the pick was purposely driven through the aluminum in 20 places, examination six months later showed that no corrosion had gone on behind the aluminum at those points. The spots were repaired and after another year's trial the proof was complete that aluminum was not attacked by hydrogen sulfide. A large refinery in the Chicago area proved that corrosion in a bubble tower was prevented by a lining of aluminum 0.008 inch thick instead of the usual 0.015 inch.

Acid-treating tanks, and storage tanks even of the floating-roof type can be protected by metallizing. An acid shell used for the continuous treatment of gasoline was protected by spraying with lead in April, 1933. By June of 1934, it had given no sign of leakage or deterioration. Pipe lines may be protected against corrosion by spraying with zinc; and return bends, tube sheets, and heads in heat exchangers have been coated successfully. Blowers are coated with lead in many refineries. Coke is removed more easily if the aluminum coating is whitewashed.

Crude Oil Not Extensively Used Under Domestic Conditions

Please name some of the domestic, household and medicinal, uses where high grade crude oil would be of value. We would like some information covering crude oil for treating skin diseases of animals.—J. C.

The use of a high gravity, volatile, crude oils under domestic conditions is not advised, because the ordinary person is not familiar with the hazardous properties of such oils. When a hydrocarbon oil is exposed to the air there is always the danger of a spark or an open flame to cause an explosion and fire. There are so many other liquids that are safe to use for the specific purpose about the household that there is little reason for one to consider using petroleum under the same conditions.

Crude oils are extensively applied as a dip and wash for the treatment of animal skin diseases and to kill insects. Crude oil is sometimes used alone for such purposes and frequently in combination with other substances. A similar use is as an agricultural spray, especially in horticulture, for the control of parasites and objectionable insects. Large quantities are used on dirt highways, also for treating the shoulders of paved highways and along the railroads right of way to prevent the growth of weeds.

Gruse states, in Petroleum and Its Products:

"The use of crude oil or of petroleum fractions as insecticides is a very old practice. The method is successfully employed against soft-bodied insects and those provided with sucking mouth parts, since the action of the oil depends upon actual contact with the insect, producing corrosive action on the cuticula, or suffocation.

"The oils are used as such in very few cases; they are very successful when spread in films on water to prevent the breeding of mosquitoes, and they have been used to a limited extent as direct sprays for fruit trees menaced by scale insects. For mosquitoes any oil nonviscous enough to spread well and nonvolatile enough to persist will serve (mixtures of petroleum oil and pine oil are recommended), while for sprays crude oils are less injurious to trees than the nonviscous distillates. Their effect is also more persistent, because evaporation leaves a small residue of heavy oil.

"Application of unmodified oils to trees and plants is usually more or less injurious. In order to minimize the tendency to injure vegetation and at the same time to reduce the cost of treatment, it has become necessary to emulsify the oil with soap solution, the final emulsions containing in most cases 4 to 6 per cent of oil. Mechanical mixtures or unstable emulsions are recommended. Lubricating distillates are used for this purpose, since their properties give them a high toxicity to insects."

There is not much merit to any suggestion to use a crude oil as medicine. The pharmaceutical or medicinal oils are mineral oil fractions that have been highly refined. The internal use of such oils is recommended not as a medicine, but simply as a diluent and lubricant.

Petroleum is valued as the raw material for the manufacture of many useful products and there appears to be no reason to endeavor to seek a market for the unrefined oil.

Natural Gas a Simple Asphyxiant With No Injurious After Effects

Can you give me any data on the effects of natural gas on the human system? Is it injurious from being in contact with it over a period of time?—F. K. S.

Natural gas as it comes from an oil or gas well is composed of a mixture of the lower hydrocarbons, the largest portion being the simplist hydrocarbon methane, usually present to the extent of about 90 per cent. The others are the next members of the paraffine series, such as ethane, propane and butane.

All of these are compounds having a faint pleasant etherial odor. They are not toxic but are simple asphyxiants, acting only because when breathed they prevent the required supply of air entering the lungs. A person asphyxiated from breathing natural gas may die for the same reason that water causes death by drowning. The water is not poisonous but it serves to cut off the air supply. A person overcome by natural gas, simply unconscious, will soon revive when placed in fresh air. There are no after effects from asphyxiation by natural gas.

There are a few natural gases that contain a poisonous impurity, hydrogen sulfide, which in a few instances is present in large enough quantities to cause death when breathed for even very short periods. The authorities seem to agree that if a victim of hydrogen sulfide recovers, there will be no lasting damage to the system.

The quotation following is from Henderson and Haggard, Noxious Gases.

"The action of hydrogen sulfide upon the nervous system is exerted only during the time the free hydrogen sulfide is in the blood and to a degree depending upon the concentration present. The symptoms of acute poisoning develop immediately on the inhalation of the gas; but because of its rapid oxidation in the blood they pass off when the inhalation ceases. Death in acute poisoning is as rapid as in poisoning by cyanides; a man inhaling a high concentration drops dead. Hydrogen sulfide is in a high degree a noncumulative poison; thus if the victim is revived there are no systemic sequelae. In less severe poisoning, convulsions and dyspnea are marked symptoms. The subacute of chronic poisoning the main symptoms are those of irritation, particularly of the eyes, and to a less degree of the respiratory tract. In some cases the depressing action of the gas is also evidenced in a mild degree of malaise. The limit of danger for prolonged exposure is said to be a concentration of 50 parts per million or possibly lower."

Compulsory Use of Olive Oil in Lubricating Oil Proposed

We are advised that an order has been issued by the French government requiring a vegetable oil to be mixed in all lubricating oils used in the French colonies. Do you have any information about this?—T. N. I.

We are informed that a bill has been submitted to the French Chamber of Deputies in which it is stipulated that olive oil in the proportion of 20 per cent shall be blended with all lubricating oil used in the Algerian territory. This relates to the crop of olive oil so important in Tunis, which has been produced in quantities exceeding the demand, so this bill has for its object a means to provide an outlet for a part of the olive oil. Should the proposal become a law, the trade will have six months' notice. This is the only reference we have to the compulsory use of a vegetable oil in lubricating oil.

PROBLEMS FROM READERS

Edited by T. F. Smiley

How to Shut Off Water and Complete Well Presents Difficult Problem

A well I am drilling, now 2,800 feet deep, has penetrated the Cambrian formation, with indications of uncovering oil and gas. There is about 2,500 feet of salt water in the hole, coming from the 2,100-foot level. Gas bubbles through in sufficient volume to light and continue burning for short periods. Sand cuttings are very greasy. The slush shows streaks of pure oil. There is 60 feet of drivepipe and 510 feet of 5⅝-inch casing cemented in at the top. How to repair the hole and proceed from this point is my problem. Three suggestions have been made: (1) Continue drilling to the bottom of the formation, run a string of 3-inch tubing, with possibly two anchor packers; perforated pipe below the packers, also working barrel. (2) Run a string of 4½-inch casing with anchor packer, set at top of this formation, perforated pipe at the bottom, then continue drilling with a small string of tools. (3) Run 5-inch casing without collars, but with beveled ends, and weld each joint; set a cement bridge at the top of the formation, run casing to near top of the bridge, run large quantity of fine cement, then lower casing almost to top of bridge; run more water into casing to make the cement work upward, then set casing and continue drilling. What would you advise?—M. G. W.

With the string of 5⅝-inch casing set and cemented at 510 feet you have little chance of reducing the hole by running another string of casing to shut off water and still leaving a large enough hole in which to run tools to drill this crystalline rock. It might be possible for you to mud off this water sand and leave the present diameter of hole for deeper drilling with only the gas sand open above the bottom of the hole.

To mud off the water sand it is suggested you prepare a bridge made from a bundle of twigs wrapped in burlap to about the diameter of the hole and forced to a point some distance above the top of the gas sand and well below the water sand. You have over 600 feet of interval between these two sands and if the formations in this section stand well it should not be difficult to place this bundle of twigs as the base of the bridge. After the bundle of twigs, which should be 6 to 8 feet long, is placed, throw enough broken brick or tile on top of it to fill 15 to 20 feet of the hole. Next above this broken material dump sand with bailer until you are certain the space between the broken brick or tile is filled and part of the sand extends above the top of the broken material. Then fill the hole for 200 feet with sand and tamp it down and on top of it run with bailer a good grade of clay to form an impervious seal and top for the bridge.

With this seal in place the hole will be in shape for the running of mud into it and forcing this mud into the water sand.

As the 510 feet of 5⅝-inch casing is cemented in the hole it is suggested a 5⅝- to 2½-inch casinghead with side openings be placed on the upper end of the casing. Run a string of 2½-inch tubing through this head and bottom the tubing opposite the water sand. Connect to the side opening on the casinghead and run a line to the pit. Connect the discharge side of the steam pump to the upper end of the 2½-inch tubing and pump the mud down the tubing and the returns will come up between the tubing and the inside of the open hole and casing.

As soon as circulation in this system is established the quantity of mud returning to the pit can be checked against the mud pumped into the tubing and if it is noted that part of the mud is not reaching the surface it is safe to assume it is entering the water sand. Continue to pump mud into the hole until the mud returns equal the mud handled by the pump, when it will be evident the water sand no longer will take mud.

Next connect the pump to a fresh water supply and wash the mud out of the hole with this fresh water and when clear water returns are obtained it will indicate the hole is full of clear water only. To remove this water connect a line for gas under pressure or pump air under pressure down the tubing and the water should be forced out of the hole. If it is not feasible to remove the water by air or gas lift the tubing can be pulled and the hole bailed down and if this can be done it is certain the water sand has been sealed off. After that it is only necessary to go in with cable tools and drill up the clay and sand bridge and deepen the hole as desired.

Readers are invited to send questions relating to drilling, producing and transporting operations. These questions will be referred to persons capable of answering authoritatively. The names of those writing for information will be held confidential, initials only being published. This department cannot undertake to answer questions involving royalty or other investments, patents or intricate formulas or questions which should be submitted to consulting engineers, geologists or lawyers.

WHY THEY CALLED IT *Eternal Fires*

The "Eternal Fires" of Baku, frequently referred to by oil historians, were once objects of worship, and among the derricks that now stud Sukakhany, near this rich oil field, there still remains part of an ancient temple. Here one of the sacred flames, described by Marco Polo in the thirteenth century, burned. Superstitious Hindus came from distant points to perform religious rites, believing the supposedly miraculous fire had been in existence since the flood and would last to the end of the world. The temple ruins and the gas seepage are near the contact between the large Serpentine mass and a massive limestone. The region is subject to earth movements, and geologists say the friction of rock against rock ignited the gas issuing from a crack in the earth. A practical-minded generation now pipes the gas to the city of Baku.

Finding Fluid Level for Determining Pumping Rate and Tubing Depth

I have been advised to ascertain the fluid level of one of my wells in order to find out the best rate for pumping it and also to know the right tubing depth. Will you please give me directions for ascertaining the fluid level? What type of pump is best?—N. O. D.

You do not mention whether the well in question is a small or large producer. If it is a small well it should stand for at least 24 hours before you proceed to ascertain its fluid level. While information concerning the height to which the fluid will rise in the hole is of great importance, it frequently is desirable to know how high the fluid stands in the well during pumping and what effect on the fluid level is produced by changing the pumping rates and tubing depths. This department is indebted to H. C. George, head of the school of petroleum engineering in the University of Pittsburgh, for the following answer to your question:

The fluid level can be determined approximately by running the bailer as soon as the tubing is pulled and again before it is "run in." These data are of interest, particularly if the tubing is pulled as soon as the well is shut down, because it gives information as to how fast the fluid comes into the hole.

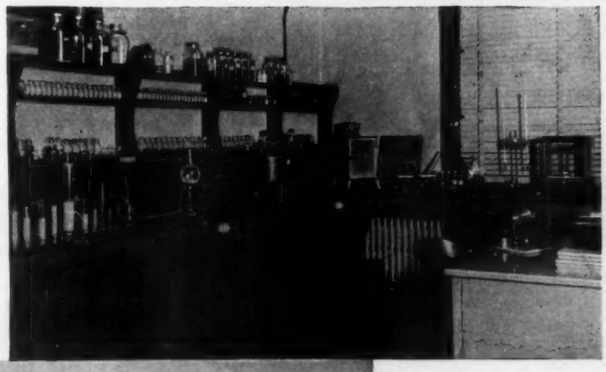
If the standing valve is pulled, some fluid drains from the tubing into the hole and thus affects the fluid level of a deep hole if the level during pumping is low and the tubing is of 3- or 4-inch diameter The oil in the tubing above the fluid level outside the tubing runs into the well as the standing valve is pulled, and the resulting fluid level outside of a string of tubing will not be the level at which the oil stands during pumping. If the standing valve is not pulled, considerable fluid may be lifted from the well while the tubing is being pulled, particularly in deep wells with high fluid level and large-sized tubing. In this case the fluid inside the tubing that was balanced by the fluid outside the tubing would be effective in changing the level at the time of pulling. Fortunately, however, the film of oil on the tubing indicates the exact fluid level in the well at the time the tubing is pulled. Running the bailer just after pulling tubing will give erroneous results.

There is seldom need of checking the fluid level in wells where the fluid comes in slowly enough to insure reasonable accuracy in observing the fluid level on the tubing. Wells of this type usually pump down and begin to pound down, indicating that the fluid level is near the working barrel. However, there are times when the pumper will be surprised to find some wells pounding down, and he will wonder if its action is due to low fluid or to some other cause.

H. B. Hill, of the United States Bureau of Mines, has suggested the following method for determining the rate at which fluid enters a small pumping well: In shallow wells and wells of medium depth, bail the fluid approximately to bottom, and then by running a float (wood, bottle, tin container) on a measuring line, observe the rate at which the fluid builds up in the hole. In the absence of "caves" or shot holes, the volume of the open hole can be calculated, and the quantity of oil standing in the casing can be determined accurately.

In your locality the cup plunger pump should be satisfactory. As a matter of fact this type of pump has been generally adopted in fields east of the Mississippi River because the light oil and hard sands are favorable to it. It is adapted to other fields also.

MODERN FACILITIES



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MODERN REFINING

ENCOURAGED by 10 months of stabilized refined oil prices, record motor fuel consumption, controlled crude production and declining total oil inventories, the manufacturing branch of the petroleum industry is ready to resume its natural program of plant improvement and modernization which it was forced to partially turn away from in 1930 in order to weather five years of adverse, general economic conditions and a flood of cheap East Texas crude oil.

In its application this program means something different to each one of the 300 or more refining companies. To some it involves shutting down poorly located plants and replacing with new ones in areas nearer the oil consuming market or crude supply. To the great majority, however, it simply means the discarding of obsolete equipment and replacing with new in order to make a better product to meet changing market demands. In but very few instances are plans made to expand the existing refining capacity.

The 504 plants now operating have a combined crude oil processing capacity of 3,970,830 barrels daily and actual runs are but 70 per cent of the capacity.

The demand for better oil products on the part of the public is making it necessary to adopt more expensive and more elaborate refining procedures, which in turn threatens to hasten the abandonment of certain uneconomic plants to concentrate refining in fewer but larger units.

Technological changes are being made rapidly in the design of equipment and procedure of refining, which, authorities have stated, render obsolete at least 60 per cent of the present refinery equipment.

On the other hand, certain technological changes are opening up an entirely new field of endeavor. They tend to lift refining out of the routine of recovering and "refining" the natural oil fractions contained in crude petroleum and treat crude oil simply as a convenient raw material to supply carbon and hydrogen in the most economical form, these to be torn away from each other as they exist in the natural oil to be recombined in a different arrangement to make better products and many more of them. The way is being distinctly marked by the rapid extension of oil and gas cracking, dehydrogenation, catalytic and thermal polymerization and hydrogenation as applied to the manufacture of motor fuels and chemicals. The use of selective solvents, highly reactive metal salts and additives for the dewaxing, polymerization and compounding of better lubricants is proving equally revolutionary.

In a brief manner The Oil and Gas Journal offers in the following pages feature articles and pictures illustrating but a portion of the construction work and laboratory research now in progress along these lines.

New Combination Units

Last year a single "combination type" distillation unit processed 10,000,000 bbls. of crude oil and produced $18,000,000 worth of practically finished products. The cost of the equipment represented an investment of more than $2,000,000. This year at least four similar combination skimming and cracking units will be completed at widely scattered points within the United States, each larger than the one mentioned here.

Mindful of the work now in progress and contrasting the new distillation equipment with the $20,000 shell still of 1916, which could not even skim 10,000,000 bbls. of oil in two lifetimes, one is inclinded to wonder what may be expected to develop along such lines within the next 20 years.

An attempt to answer that question could be but a guess at best; however, certain trends are apparent and men close to the actual design and operation of distillation equipment agree on a number of probabilities. In general, they endorse the combination skimming and cracking unit as the most economical means of manufacturing motor fuels of relatively high antiknock value. They point out that over the next five years there will be an expanding demand for motor fuels of 70 octane value or better and for 100 octane motor fuel for aviation purposes. In the past five years there has been a tendency among refiners to allow their equipment to run down, and because of adverse price conditions they did not replace their cracking and crude distillation equipment as they would do in normal times. The result is that both kinds of equipment were nursed along, the greater amount of money and attention was given to the weaker, until now the two are about equally well worn out and the replacement may be done most economically by installing a combination unit.

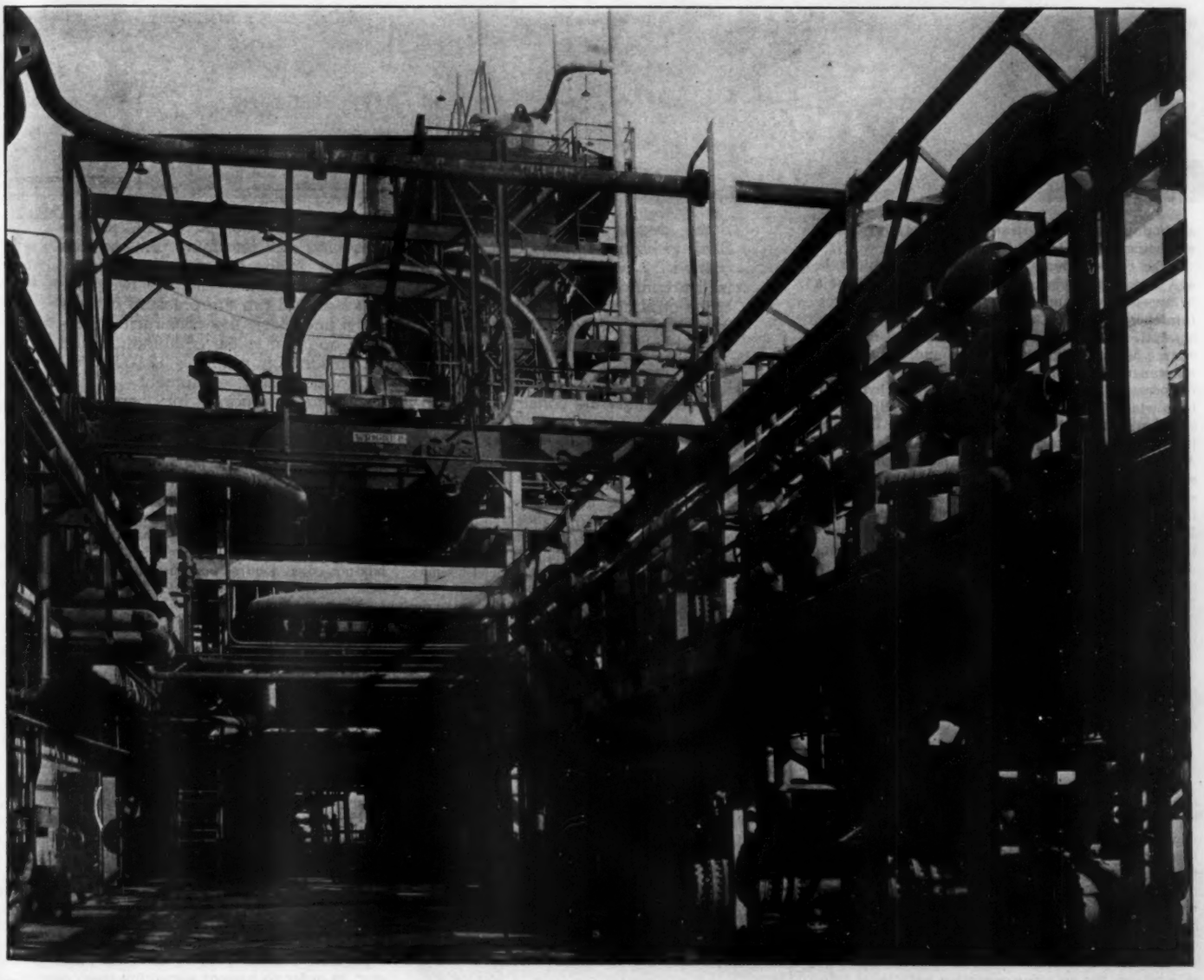
More Economical

The combination unit conserves heat, it requires less labor, eliminates a certain amount of ordinary small tankage and there is substantially less oil to be carried as working inventories.

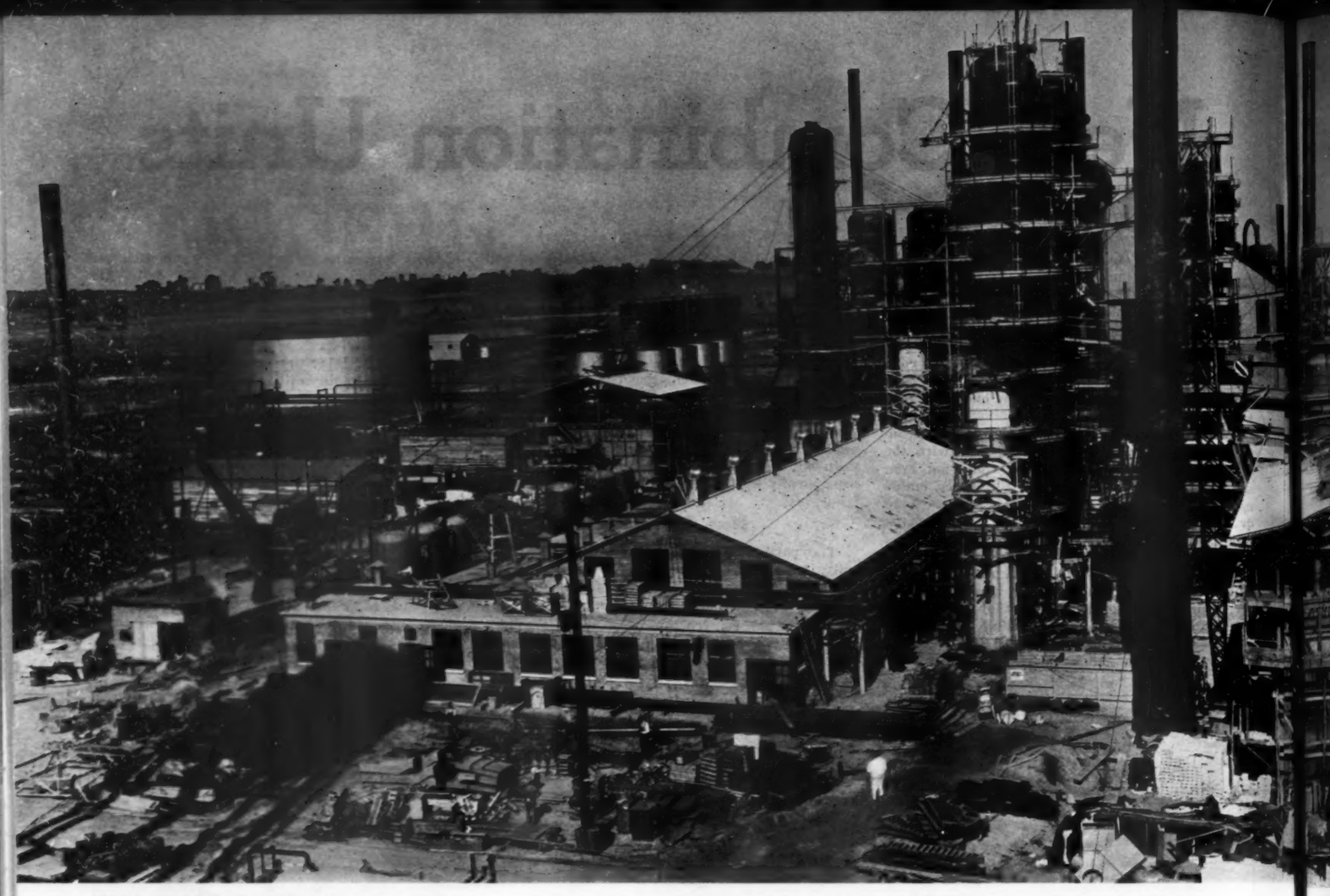
To date the construction of combination units has been limited to those refineries of abnormally large capacity, but this is not considered a criterion of their application. The average combination unit processes from 20,000 to 30,000 bbls. daily. Obviously, small combination units will have to be developed if they are to find general application throughout the refining industry, and at least one of 6,000 bbls. capacity will be installed soon.

At first some critics of the combination unit stated that it could not be flexible. This argument is believed to have been answered, however, by the units already operating and under construction, for they are designed to process a relatively wide variety of crude oil, are able to finish several grades of kerosene and furnace oils, produce suitable lubricating oil stocks and operate to produce a dry residuum or coke.

They are equipped to stabilize the cracked distillate within the unit, and by means of recycling and closely fractionating the cracked vapors, it is possible to improve gasoline yields by 1 to 3 per cent over the conventional methods, raise the octane value from one-half to 1½ numbers and practically eliminate the conventional vapor recovery plant. To date no announcement has been made of the perfection of a unit which combines cracking,



One end of the 30,000-barrel combination cracking unit located in the Pan American Refining Company's new plant at Texas City, Tex. To the right are the various exchangers, to the left the compressor, pump and control rooms and in the central background are the fractionating towers and clay vapor phase treating drums. The two large furnaces used are at the opposite end of the unit



Some idea of the size of the new furnaces built at Wood River, Ill., for the Shell to be used in the company's new cracking and reforming unit may be gained by comparing the size of the workmen. In the foreground to the left is the control and pump house. In the right foreground are the two new types of furnaces to be used and in the background are the pressure vessels and fractionating equipment. The company undertook the construction program a little less than one year ago and in addition to the combination unit shown here, it included a 20,000,000-foot absorption plant, a 12,000-barrel per day stabilizer and solvent refining and dewaxing equipment. At the present time the construction is in its final stages preparing for operation

skimming and polymerization, but definite efforts are being directed to this end.

The combination unit of the future might be one to which is charged not only crude oil but a balanced amount of natural gas and, possibly, certain chemicals. The unit, by means of thermal and catalytic dehydrogenation, will treat the incoming charge as just so much hydrogen and carbon to be rearranged according to the prescribed laws of temperature, pressure and catalysis into hydrocarbons which in use look and act like gasoline, kerosene, etc., but which in reality are quite different in chemical structure from the natural products. And in their manufacture will be associated the simultaneous preparation of better lubricating oil stocks, and unsaturated hydrocarbons of most any type for the manufacture of chemicals and resins. In separate units these raw lubricating stocks may be processed as desired to meet any set of conditions and the unsaturated hydrocarbon gases may be processed to make a series of special motor fuels, alcohols, aldehydes, ketones, amines, esthers, chlorides, glycols and ethers. These materials enter into the manufacture of more than 50 per cent of the commodities now found on the shelves of all merchants. They represent a substantial item in the total purchases of medicines, solvents, toiletries, molded plastics, antifreeze solutions and explosives.

Present Application

But for the present, at least, the principal inducement to install a combination unit is to manufacture better motor fuels more cheaply. The mounting average compression ratio of cars on the street is making this necessary. Since 1930 the average has jumped from 5.15 to 6.15 this year, and to bring the actual need for better fuels closer to mind, the compression ratio of individual 1936 cars is listed here.

The need for the present and for the immediate future will be for an extension of cracking. For this reason, the cracking operation will become the major item in the refinery equipment, and with this so established the normal job of crude distillation will be carried out in a series of exchangers in which otherwise waste heat from the cracking unit is utilized. In this program of expanding cracking operations, the oil will be subjected to even greater pressures and higher temperatures than the average at present, necessitating in turn even more exhaustive research in the perfection of refractive furnace materials and alloys that may be used to make furnace tubes, towers and pressure vessels. The need in the development of new tubes appears to be for better heat conductivity to cope with the higher heat transfer rates used in the newer furnaces. The alloys employed at present are substantial improvements over the ordinary steel tubes where high temperatures and abnormally high pressures are employed, but there has not come a corresponding improvement in the heat conductivity of the metal.

Equally important parts of the combination units are the pressure vessels, condensers and piping, most of which now must be made from exceptionally high grade steel, forged from a large ingot or fusion welded and then thoroughly annealed. When corrosion is likely to take place they are sometimes inner lined with a protecting steel chromium alloy or sprayed with aluminum.

Centrifugal and reciprocating pumps each find a place in the operation of the combination units being built, the latter finding greatest application in handling oils of 600° F. and higher.

Clay treating and the use of various chemicals for the vapor phase treatment is being favored by many, while the use of inhibitors and modification of the older treating methods are favored by others.

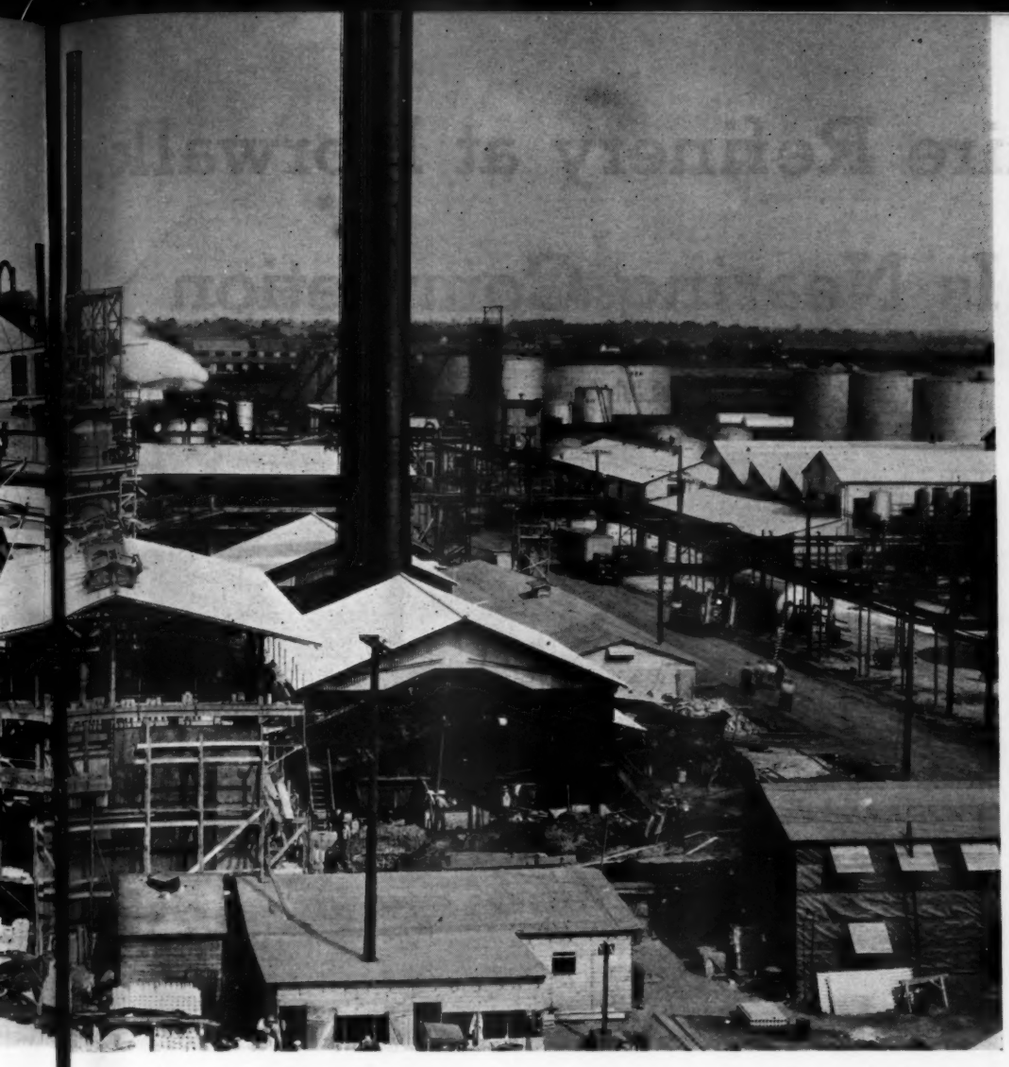
Quite naturally, there is no uniformity in the ideas of engineers and operators regarding the details of the design of combination units and no two plants are likely to be designed alike. However, in order to present something more concrete, the routine operation of a typical unit is presented here.

This combination cracking unit is not only re-

COMPRESSION RATIOS OF 1936 CARS

Make and model—	Compression ratio— Standard	Optional
Auburn 654	6.20	(*)
Buick 36-40	5.55	(*)
Cadillac V8-60	6.25	(*)
Chevrolet Standard	6.00	(*)
Chrysler Six	6.00	6.50
Chrysler Airflow 8	6 20	6.50
Cord Front Drive-810	6.50	(*)
DeSoto Airstream 6	6.00	6.50
DeSoto Airflow 6	6.50	7.00
Dodge Six	6.50	(*)
Ford V8	6.30	(*)
Graham 80	6.80	(*)
Graham Sup. Ch. 110	6.70	(*)
Hudson 6	7 25	7.00
LaFayette 1936	5.61	5 87
LaSalle 36-50	6.25	6.75
Lincoln V12-136-145	6.38	(*)
Lincoln Zephyr	6.70	(*)
Nash Ambassador	5.70	(*)
Oldsmobile F-26	6.00	(*)
Packard 8	6.50	7.00
Packard Twelve	6.40	7.00
Pierce Arrow 438	6.40	(*)
Plymouth P1	6.70	(*)
Pontiac Master and DeLuxe 6	6.20	(*)
Studebaker Dictator 6	6.30	(*)
Terraplane DeLuxe and Custom 6	6.00	7.00

*None.



quired to handle crudes of varying characteristics but is also called upon to meet the demands of an equally changeable market. During some periods of the year the production of range oils and distillate fuels represent a rather large portion of the total oil processed and the crude oil charging capacity is effected accordingly. Principally due to this factor, the daily crude capacity of the present unit is considered to be within the range of 30,000 and 36,000 bbls. rather than fixed by any one figure.

The capacity of the unit is also affected by the intensity of cracking in order to produce gasolines of varying distillation and antiknock characteristics. Normally the plant is operated to produce a motor fuel of 65 to 70 octane number without the use of lead.

The yield of motor fuel varies according to the nature of the crude and the character of the products made, but lies within the range of 40 to 45 per cent gasoline when making a relatively large cut of burning oils and from 60 to 65 per cent when the operation provides for a minimum production of burning oils. Along with being flexible in operation the combination unit has proved to be exceptionally dependable for continuous service. A normal run extends over a period of from 1,500 to 1,800 hours. On this basis the unit is down only five or six times a year. During 1935 the unit was on stream 85 per cent of the time.

Use Two Furnaces

The direct heat required for processing is supplied by two furnaces, the larger containing a coil for the single pass cracking of a naphtha gas oil mixture, another coil for vapor phase cracking and a third for preheating the crude. The second furnace contains a single coil and is used for viscosity breaking. The vapor phase cracking and viscosity breaking operations provide the recycling. Through the single pass naphtha, gas oil coil about 10,500 bbls. of stock are processed daily and about 38,000 bbls. of stock are circulated through the vapor phase coil. The coil in the viscosity breaker or smaller furnace recycles about 32,000 bbls. per day.

These figures on throughput reflect normal operating conditions but are greatly altered at times by the fact that the gasoline coming from the viscosity breaker coil is sometimes recycled through the single pass coil along with the straightrun naphtha and gas oil mixture.

The larger furnace occupies approximately 110,000 cubic feet of space and has a heat liberating capacity of 300,000,000 B.t.u. per hour. It contains approximately 5 miles of heating coil. The smaller furnace or viscosity breaker holds about 2½ miles of coil, occupies a space of approximately 45,000 cubic feet and has the capacity to liberate up to 140,000,000 B.t.u. per hour.

Both furnaces utilize parallel flow. Actual fuel consumption for the unit approximates 5¼ per cent or from 5 to 5½ pounds of fuel per 100 pounds of crude charged.

Briefly stated, the operation of the unit essentially provides first for taking off a cut of straightrun naphtha of low endpoint, a relatively heavy straightrun naphtha and kerosene. After removing the light gas oil from the topped crude, the bottoms, together with a heavy recycle stock, are cracked in the viscosity breaker coil. The light virgin gas oil and cycle stock of similar boiling point range are cracked in a vapor phase cracking coil and the virgin heavy naphtha above mentioned is reformed in another coil.

Wet gases resulting from depropanizing the straightrun light naphtha and from the viscosity breaker are compressed and combined with a cracked gasoline of about 420 endpoint gathered from the various cracking coils to make up the charge to the clay towers.

The quantity of virgin naphtha thus introduced by blending is small and represents less than 5 per cent of the cracked gasoline.

The job of charging 30,000 to 36,000 bbls. of crude oil to the unit and circulating the oil within the unit requires the services of 23 pumps. The policy of the company is to have one pump in reserve for each two pumps in operation.

In all the total oil pumped through this unit daily approximates 350,000 bbls. or is equal to 80 per cent of the volume of crude oil being produced in the entire East Texas field.

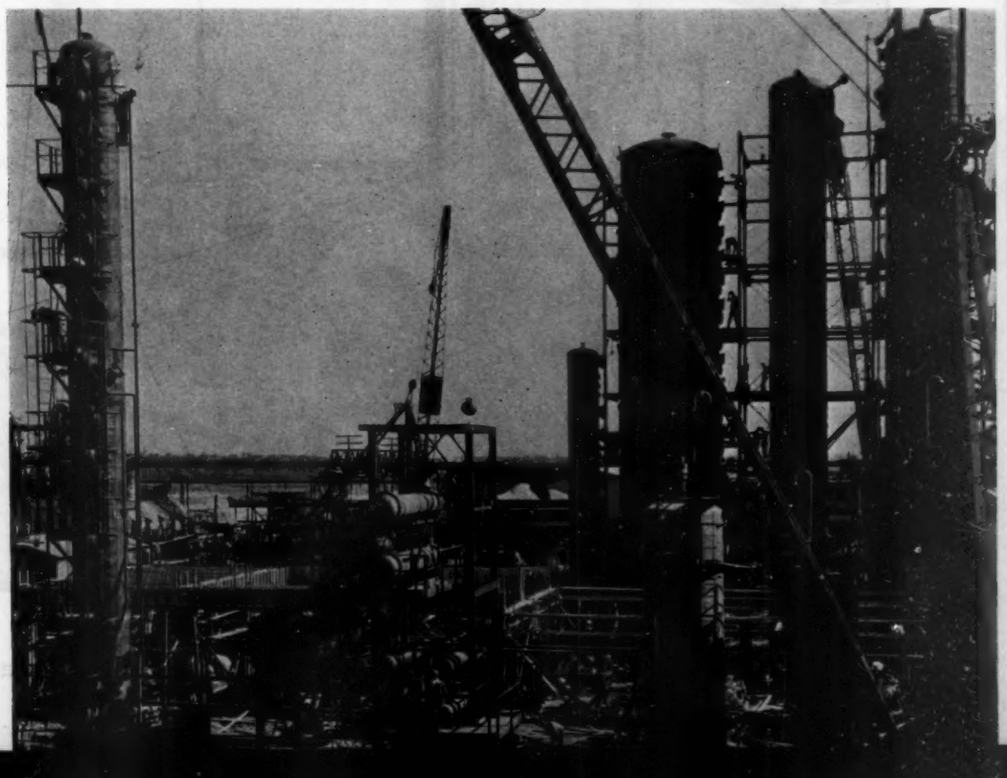
This work is approximately divided among pumps which are electrically and steam turbine driven with a few pumps in use of the reciprocating type.

Vapor Phase Treaters

A most interesting part of the unit is the series of four Gray towers connected in parallel for the vapor phase treatment of the cracked gasoline. Each contains about 25 tons of earth and more than 3,000,000 bbls. of gasoline have been treated by a single batch of clay.

All cracked gasoline vapors enter a header to which is connected four 12x19½-foot clay drums. These vapors enter at the top and by controlling pressure differences the vapors pass downward through the bed of earth and through the false bottom. The liquid polymer and some condensed fractions in the upper gasoline boiling range are drawn from the clay towers to a common polymer drum from which they are returned to the fractionating system. There the heavy polymer is removed as part of a tar and the light hydrocarbons are recycled through the cracking unit.

Construction picture taken at the Beaumont, Tex., refinery of the Magnolia Petroleum Co. showing installation of a 32,000-barrel per day combination cracking and skimming unit now under completion

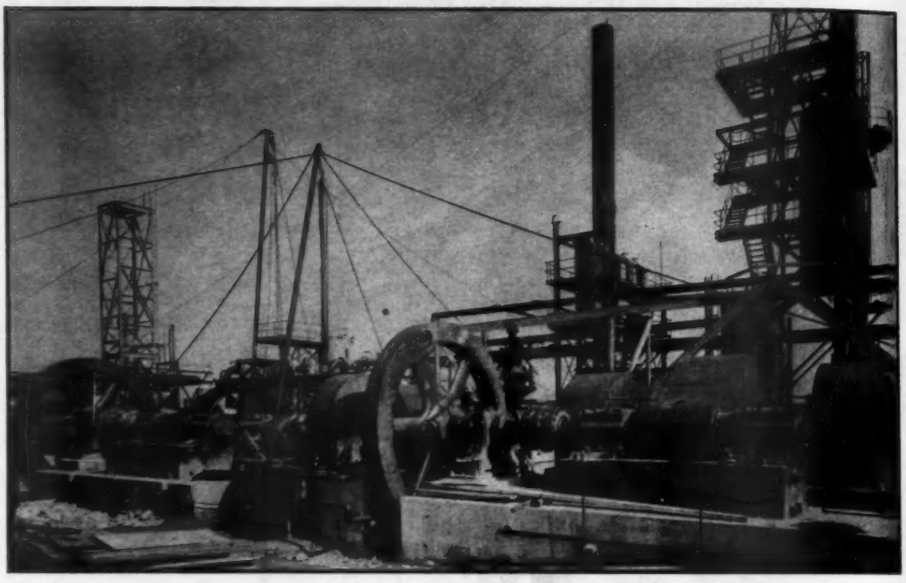


Large Wilshire Refinery at Norwalk, California Is Nearing Completion

By L. P. STOCKMAN

The Wilshire Oil Co.'s new refinery at Norwalk, Calif., is rapidly nearing completion and should go into operation on or before May 1. It is being constructed on the company's 250-acre tank farm near Santa Fe Springs and will have a rated capacity of 12,000 bbls. per day on straight-run distillation and a cracking capacity of approximately 7,800 bbls. daily. Contracts were signed with Universal Oil Products Co., owner and licensor of the Dubbs cracking process, in January last year and construction begun late in March, 1935. One year after commencement of work practically all major equipment is in place and the finishing touches are being put on. This plant, being erected by Ralph M. Parsons Co., will represent an expenditure of approximately $1,000,000. A considerable quantity of equipment consisting of steel tanks, pipe, some fittings and other usable equipment will be salvaged from the company's refinery at Vernon. In addition to the actual distillation units and cracking plant, the company has erected an entirely new series of treating and processing tanks and necessary equipment.

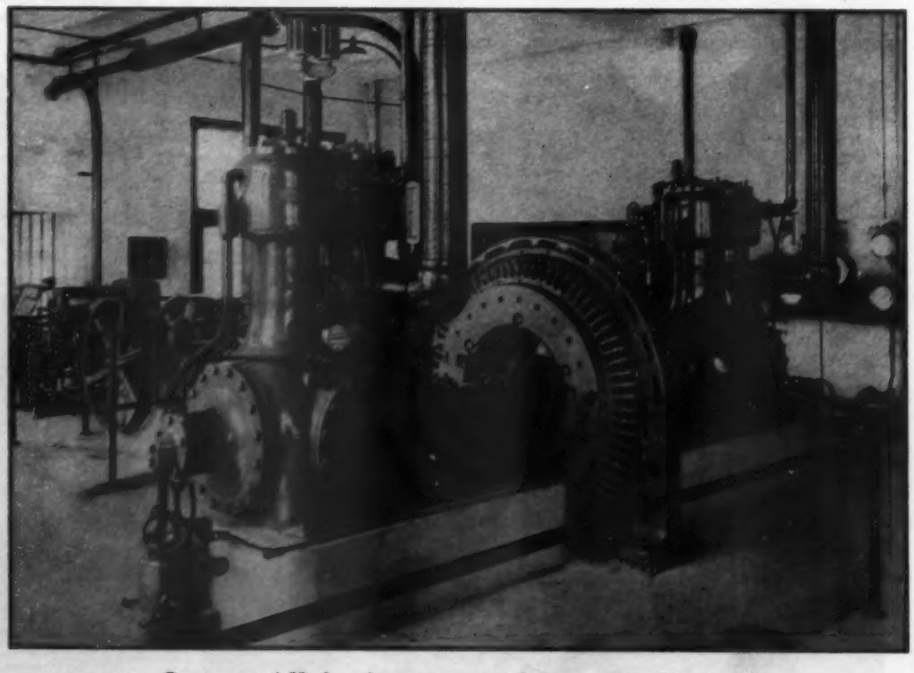
Upon completion, Wilshire Oil Co. will have one of the most modern refineries on the Pacific Coast, although the range of products will not be comparable with larger and more complete plants. Wilshire's new refinery has the largest cooling tower in refinery service on the Pacific Coast, exceeded in only a few cases where large towers have been erected in natural gasoline plant operations. This tower, erected by Fluor Corp., required 20 carloads of California redwood and 6,000 pounds of brass bolts. It was constructed in approximately 60 days. It is 18 feet wide, 786 feet long and 43 feet high over all and has a capacity of 10,000 gallons per minute, the cooling action resulting in a temperature drop from 125° F., to 80° based on a 70° wet bulb and zero mile wind. This tower was built at the insistence of engineers and Wilshire Oil Co. in order that maximum efficiency could be expected under the most adverse conditions. The safety factor is sufficiently high to provide efficient operation even if there was no wind.



Worthington steam driven hot oil power pump installation

Distillation Equipment

The three primary distillation towers are of heavy reinforced construction and weigh in the aggregate 238 tons. The fractionating column measures 11 feet, inside diameter, and is 74 feet 6 inches high. The upper section of the walls are seven-eighths inch thick while the lower section is 1¼ inches thick. It contains 16 plates and weighs 90 tons. The reaction chamber is 7 feet, inside diameter, by 50 feet in height and the walls are 3 inches thick from the upper to the lower head. It weighs 93 tons. The flash chamber, 11 feet inside diameter, and 40 feet long, has walls 1¼ inches thick and weighs 55 tons. Considerable attention has been given to metallurgical problems. Corrosion liners were used in the reaction chamber, main fractionator and flash chamber. As a further safety factor, all connections in the process area are 4 to 6 per cent chromium (chrome) with .5 per cent molybdenum. The use of chromium and molybdenum was deemed necessary because of the highly corrosive stock to be processed and to increase the safety factor. All valves and fittings are of steel construction, to withstand earthquake shocks, whereas it has been customary to use cast iron equipment.

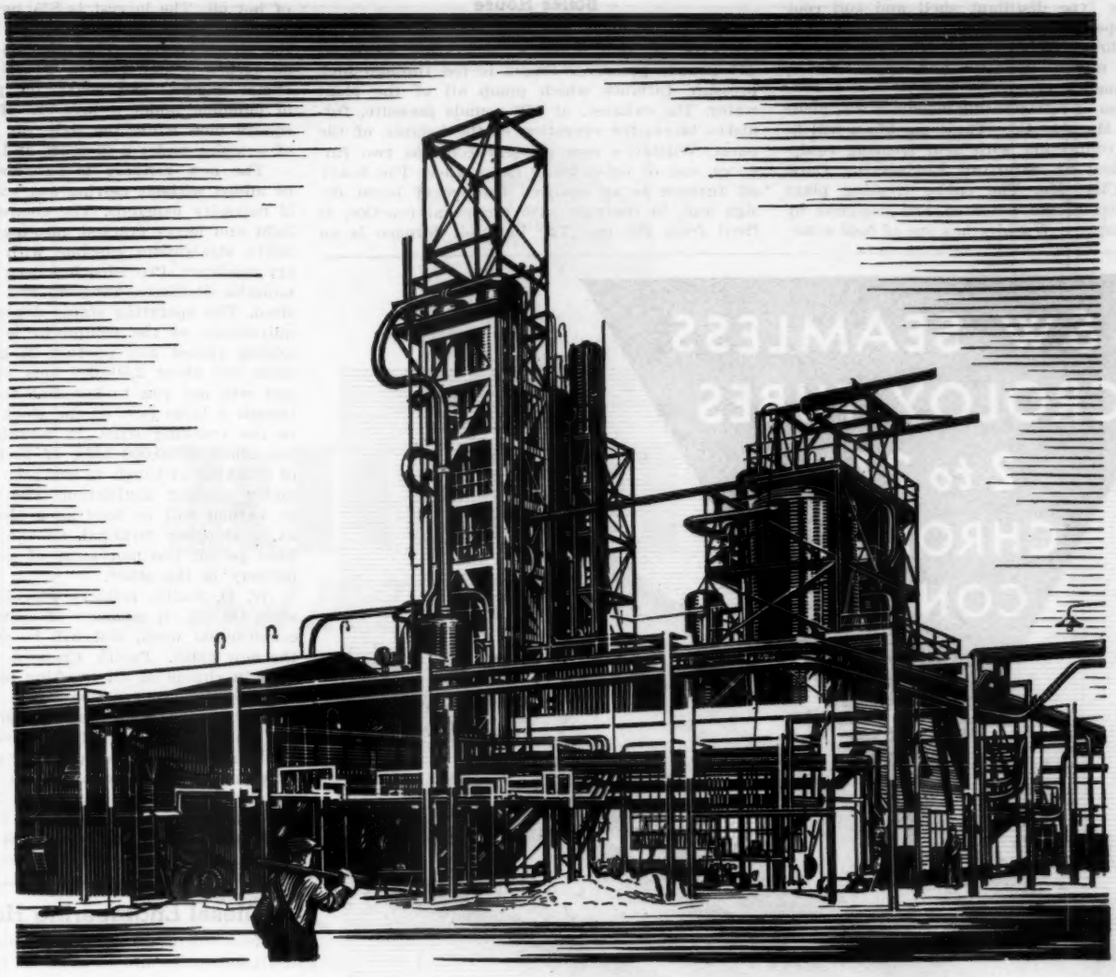


One unit of York refrigerating machine at Norwalk plant

There are four sets of heat exchangers on the distillation units, one on the rerun unit, four on the Dubbs unit and one on the refrigerating unit in addition to several others at necessary points. There are about an equal number of condensers. Wilshire's treating plant is the only combination cold process with centrifugal separation in existence. The oil to be treated will be cooled to 20° F. The redistillation unit employs a bottom fired equiflex heater designed by Ralph M. Parsons Co., and is of unusual construction. After the oil is cracked and treated it is charged to the redistillation unit where it is rerun to make a stabilized a product of standard specifications. The centrifuge equipment, of which there are several units, was installed by National Acme Co.

Refrigerating Equipment

The refrigerating equipment was constructed to be used in the pressure distillate treating plant and was built to handle approximately 6,000 bbls. of 59° A.P.I. gravity pressure distillate per day through three stages of treatment. The refrigerating unit is a complete refrigerating plant designed to operate in conjunction with the acid treating system installed by Stratford Engineering Corp. In general, the refrigerating equipment



Crudes covering a wide range of gravity are handled in a KELLOGG COMBINATION UNIT

● Recently a Kellogg combination topping and cracking unit was designed to process five crudes covering a wide range of gravity and straight run gasoline content.

● This unit has not only successfully processed the crudes specified but has handled other crudes without change in equipment to interrupt the steady production of high octane gasoline.

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consists of four refrigeration compressors having a refrigeration capacity of approximately the equal of the melting of 400 tons of ice each 24 hours. These compressors are driven by synchronous motors supplemented by ammonia condensing equipment consisting of shell type condensor and receive the necessary evaporating surface in the shape of three 48-inch diameter by 10-foot high special spray type distillant shell and coil coolers with proper ammonia controls and regulators. There are three 250-horsepower General Electric synchronous motors installed and approximately 50 of the smaller type.

Installation of refrigerating machines was made by York Ice Machine Co. These machines will be operated in connection with acid treating equipment furnished by Stratford Engineering Corp. of Kansas City, Mo. The entire treating plant is of a special design patented and designed by the latter company. Wilshire has one of four somewhat similar refrigerating plants on the Pacific Coast. A number of years ago, Standard Oil Co. installed a primary refrigerating plant and subsequently installed a second unit. The other refrigerating unit of this type was installed by Associated Oil Co. a few years ago. The Wilshire unit is the most complete of its kind.

Boiler House

The boiler house is the latest and most modern type of high pressure, generating steam at 475 pounds pressure. Steam is fed through high pressure turbines which pump all of the plant water. The exhaust, at 150 pounds pressure, furnishes steam for operation of the balance of the plant. Wilshire's new refinery contains two furnaces, one of outstanding importance. The heavy oil furnace is an equiflex furnace of latest design and, in contrast with the usual practice, is fired from the top. The light oil furnace is an Alcorn furnace of conventional type. The company has developed its own water supply by drilling six wells and has a 200,000-bbl. concrete lined reservoir. In addition to other unusual equipment, the refinery has two horizontal steam engine driven reciprocating power pumps for hot oil charging. These two pumps are the largest of their kind in use in the United States for charging of hot oil. The largest is 8½ inches by 30 inches actuated by a Worthington 22 by 24 Worthington steam engine. The other is a 6¾ inches by 30 inches actuated by a 23 by 24 Worthington steam engine. The heavy oil pump is capable of pumping under a pressure of 900 pounds per square inch while the light oil pump is capable of pumping under a pressure of 1,350 pounds.

The new refinery is so arranged units may be added without moving any existing equipment if necessity demands. The company will make a light and heavy cracked gasoline and a light and heavy straightrun gasoline with the usual refinery residuum. Provision has been made to produce naphtha distillate, kerosene and diesel oil if desired. The operating status depends upon the requirements as the equipment is capable of producing almost any product in general use. Wilshire has about 2,500,000 bbls. of kerosene stock and will not run to kerosene for some time, although a large part of the stock will be charged to the cracking stills. In addition the company has about 2,000,000 bbls. of fuel oil suscepitible of cracking although it has been cut rather deep under straight distillation. The present refinery at Vernon will be used as a blending plant and as a shipping terminal as the company's pipe lines permit the movement of gasoline from one refinery to the other.

W. D. Smith, refinery superintendent of Wilshire Oil Co., is manager of operations, including construction work, and will be superintendent of the new plant. Pacific Crane & Rigging Co. has been in charge of all trucking operations in connection with construction work. The contractors are laying the crude and refined oil lines from the tank farm and distillation units to the tanks. The finishing touches are being put on a stucco building to house administration offices and laboratory. The control house with its valves, gates and fittings is ready for use. Special care has been exercised in the installation of ventilation to prevent concentration of explosive vapors.

Diesel Engineering Handbook

Diesel engines are rapidly winning recognition in all industries and to meet the exacting requirements designers and manufacturers are making improvements constantly. Literally thousands of operating engineers, designers, engine builders, consulting engineers, prospective diesel users, investment houses, bankers, railroad officials and others in all branches of industry are interested in these changes and improvements.

To meet this need the technical staff of Diesel Publications, Inc., under the direction of L. H. Morrison, editor, has prepared a very comprehensive book known as "Diesel Engineering Handbook" in which a mass of data has been accumulated and presented in a form best suited to meet the needs of all interested in diesel engineering.

The book contains more than 825 pages and is divided into 40 chapters, each chapter dealing with some particular phase of the problem. The book is well illustrated and contains numerous formulas and graphs giving solutions to the various problems common to diesel engineering. Copies may be secured from Diesel Publications, Inc., 192 Lexington Ave., New York City for $5.00 each.

Reports of A.S.T.M. Meeting

As usual the report of the proceedings of the annual meeting of the American Society for Testing Materials is very complete and is published in two parts. Part I, Volume 35, covers committee reports, new and revised tentative standards and tentative revision of standards, while Part II, Volume 35, contains the technical papers presented before the thirty-eighth annual meeting held at Detroit, Mich., July 24-28, 1935. Copies of Parts I and II of the 1935 proceedings can be purchased at $5.50 each in stiff paper cover; $6.00 in cloth; and $7.00 in half leather, from A.S.T.M. headquarters, 260 South Broad Street, Philadelphia, Pa.

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The Naphthenic Acid Industry

By V. L. SHIPP
Socony-Vacuum Oil Co., Inc.

The production of naphthenic acids and their derivatives is a branch of petroleum refining which, for some reason or other, has been held back in this country. Sixty years elapsed since Eichler[1] discovered the natural petroleum acids in Baku crude, and during the last 35 years the naphthenic acid refining has developed, particularly in Russia and partly in Rumania and Poland, into a sizeable and profitable industry. Exact figures are lacking, being usually included in the official statistics in the general item of "other various products." However, the following estimated data will give you an idea of the scale and increase of production of naphthenic acids in Russia:

	Lbs. (as acids)
1913	4,000,000
1928	12,000,000
1934	35,000,000

The actual output of products was considerably higher as the bulk of the production up to 1930 was commercial sodium naphthenate, a soft soap containing about 50 per cent of acids and 28 per cent of water.

American Crudes

An opinion seemed to prevail that the American crudes contain too small percentages of naphthenic acids to be of any commercial interest. There was also another contributing factor to the lack of interest in the recovery of naphthenic acids. Most of the Coastal crudes, and those are the crudes with the high acid content, when processed for lubricating oils, have been run as a rule over caustic. This method considerably simplifies the subsequent chemical treatment of the oils, but the naphthenic acids remain in the bottoms as sodium naphthenate commingled with tarry bodies, and their recovery becomes difficult and expensive.

However, a few years ago the development of lead and aluminum base greases, and then the success of naphthenate driers, imported from Germany, in the paint industry, brought about a demand for the naphthenic acids. It took little time to reverse the above opinion about the domestic sources of supply, and the production of naphthenic acids was started by several major oil companies in this country.

Although the literature on the chemistry and technology of the naphthenic acids is quite extensive, and there are numerous patents covering various phases of production and uses of the naphthenic acids and their derivatives, most of this information is published abroad, and it appears to be timely to give a brief review of the subject with special reference to the American situation for the benefit of those who are interested in this new and growing branch of American petroleum refining, but do not care for literature searches, especially in foreign languages. A brief bibliography is appended to this article. The American reader will find the most comprehensive presentation of the chemistry of naphthenic acids in "The Chemistry of Petroleum Derivatives" by Carleton Ellis[2] and in the "Scientific Principles of Petroleum Technology" by L. Gurwitch[30].

TABLE 1—NAPHTHENIC ACID CONTENT OF BAKU CRUDES

Field and base—	% N.A.	Av'ge Neut. No. of N.A.	% Yield of kerosene	% N.A. in kerosene	% Kerosene Acids on crude
Balakhany lt., Naphth	1.05	202	29.0	0.5	0.15
Balakhany hy. Asph.	1.10	205	6.0	0.5	0.03
Binagady Asph	0.85	202	6.0	0.5	0.03
Bibi-Eibat lt., Asph.	0 55	211	30.0	0.5	0.15
Bibi-Eigat hy., Asph.	0.50	205	10.0	0.5	0.05
Ramani, Mixed	0.40	205	28.0	0.20	0.05
Surakhani, Mixed	0.20	205	28.0	0.20	0.05

Note—The yield of kerosene acids is shown separately because, as will be shown below, they are the most important in the trade.

TABLE 2—NAPHTHENIC ACID CONTENT OF DISTILLATES FROM AMERICAN CRUDES

	Boiling range	Per cent N.A.
Pennsylvania, Paraff., Kerosene	350-530	0.006
(L Grade) has oil	570-650	0.010
E. Texas, Mixed, Kerosene	360-520	0.009
Mid-Continent (pipe line), Mixed, Kerosene	330-535	0.009
Mid-Continent (pipe line), Mixed, Gas Oil	575-665	0.015
Cayuga, Texas, Mixed, Kerosene	335-540	0.011
Luling, Texas, Mixed, Kerosene	300-560	0.027
Mixed Texas Light, Mixed, Gas Oil	375-740	0.041
California Mixed, Asph., St. Run, Naphtha	170-400	0.010
Kerosene	350-550	0.06
Gas Oil	500-700	0.36
Texas Heavy, Naphth., Kerosene	400-500	0 075
Gas Oil	490-670	0.35

Terminology

There is considerable confusion in the trade about the term "naphthenic acid." The following should be remembered. Naphthenic acids are monobasic carboxylic acids of the general formula R. COOH where R is a naphthene (cyclic hydrocarbon) radical. These acids exist naturally in crudes and distillates therefrom, and can be extracted by caustic wash. They should not be confused with sulphonic acids, sometimes incorrectly called sulpho-naphthenic acids. The sulphonic acids have a general formula $R.SO_3H$ and are derived from the sulphonation of hydrocarbons, e.g., as by-products from treatment of medicinal white oils and transformer oils with strong sulphuric acid. The sulphonic acids and their soaps are marketed in Europe under the trade names of Petrov's reagent or "Kontakt" and in this country as mahogany acids and soaps, their value being in their emulsifying, detergent and fat hydrolizing properties.

Commercial grades of naphthenic acids are sometimes referred to as gasoline, kerosene, or gas oil acids, depending upon the distillate from which they were extracted.

Occurrence

Naphthene and asphalt base crudes contain the highest percentages of naphthenic acids; the paraffin base crudes have negligible acid content and the mixed base crude occupy an intermediate position. Since the American refining industry originally grew up on Pennsylvania crude, practically acid free, it is natural that no attention was paid to this constituent in the past.

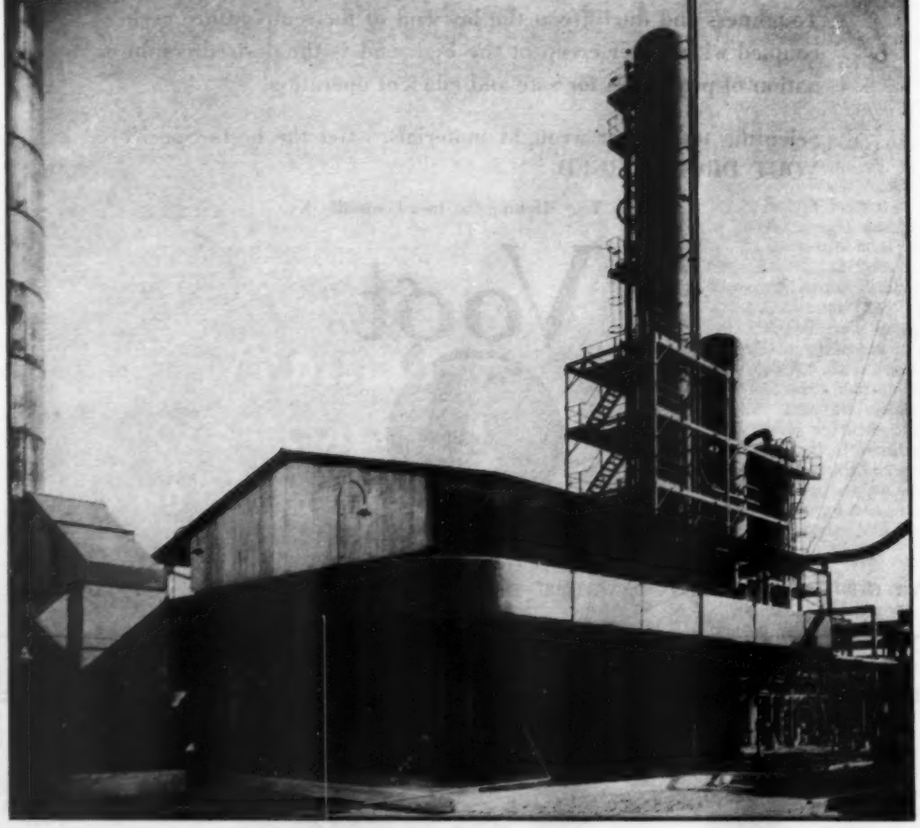
Transcaucasian (Baku) crudes are known to possess the highest naphthenic acid content. Note table 1.

No comprehensive survey of American crudes, as far as their naphthenic acid content is concerned, is available. However, the figures in table 2 will be of interest.

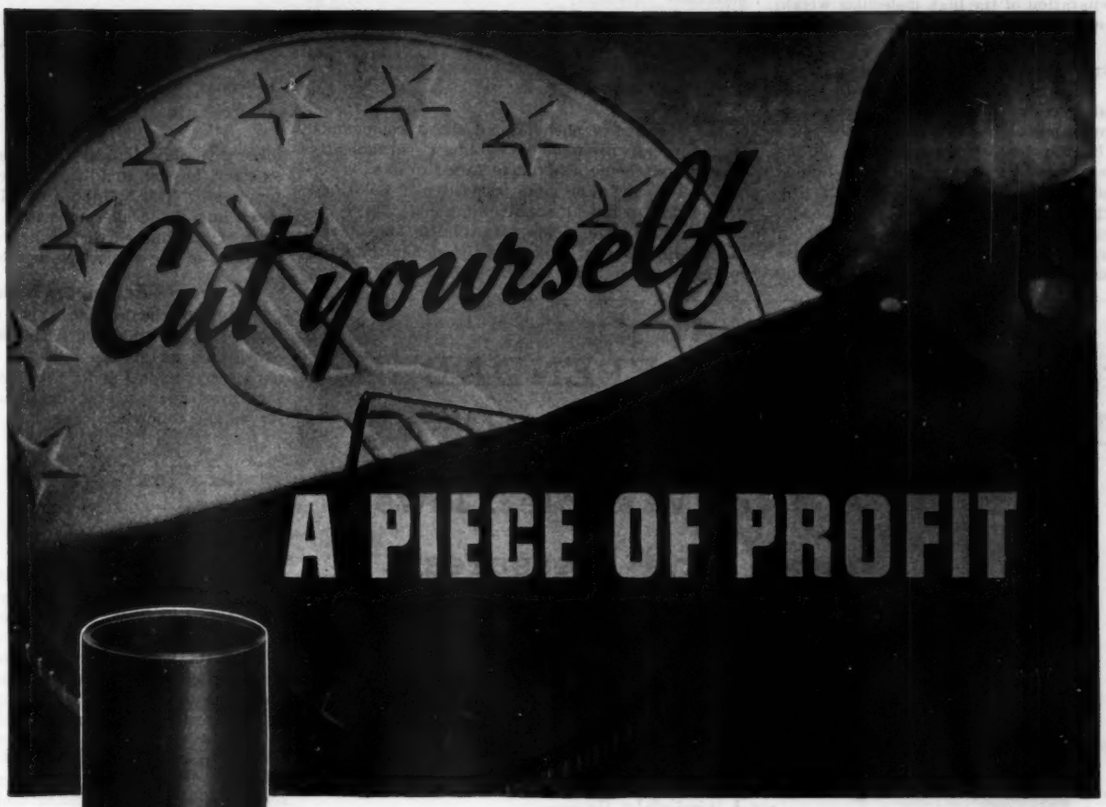
Naphthali[3] reports the naphthenic acid content of American crudes as shown in table 4.

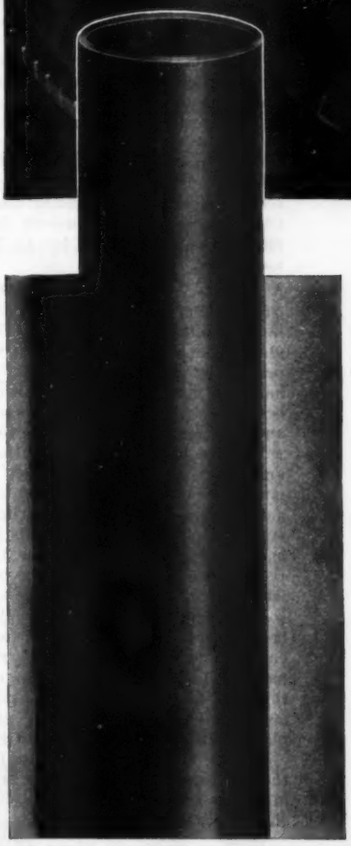
It is interesting to note that the distribution of the naphthenic acids in the distillates from a given crude is not uniform and their content usually increases from naphtha to kerosene and to gas oil reaching a peak in the medium viscosity overhead oil and then again gradually decreasing.

The commercial naphthenic acids are complicated mixtures of series



New 1,500-barrel furnace built for the Wadhams Oil Company at East Chicago, Ill.





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of acids similar to the mixtures of innumerable hydrocarbons in commercial petroleum distillates. Therefore, all properties of naphthenic acids should be considered as average for a given grade.

Only acids deriving from naphtha, kerosene and gas oil have found application in the trade chiefly because of the fact that the problem of economical separation of the high molecular weight acids from unsaponifiables has not been solved satisfactorily yet.

All known naphthenic acids when purified from tarry entrainment, phenolic and sulfur compounds, and freshly distilled, are colorless or yellowish liquids possessing a peculiar odor more pronounced in the low molecular acids. Commercial acids are reddish brown to black liquids with a characteristic pungent odor especially pronounced in the naphtha grade, less objectionable in the kerosene grade and still less noticeable in the gas oil acids. Little is known about the cause of odor. Some investigators contend that it is due to the presence of phenolic and sulfur compounds. However, all attempts to produce permanently odorless napthenic acids have failed to date.

TABLE 4—NAPHTHENIC ACID CONTENT OF AMERICAN CRUDE OILS

Source—	Napthenic acid content approx. %
Winkler County (Texas)	0.36
Howard County (Texas	0.07
Runnels County (Texas)	0.03
Hosston (Louisiana)	0.70
Saginaw (Michigan)	0.03
Smackover (Arkansas)	0 03
Mid-Continent (Pipe Line)	0.04
Mid-Continent	0.03
Pennsylvania	0.03
Gulf Coast Crude	0.60
California (Southern California and San Joaquin Valley Crude)	0.1 to 3.0

Table 5 shows the main properties of Baku and Californian technical naphthenic acids.

The naphthenic acids are volatile substances, their boiling range being slightly higher than the boiling range of the distillate from which they have been extracted. They can be distilled without appreciable decomposition, the lower acids at atmospheric pressure, the higher in vacuo. They react with bases forming salts and respond to other reactions typical for carboxylic acids, such as esterification, amidification, conversion into ketones, etc. The solutions of alkali naphthenates enter into double decomposition with solutions of salts of alkaline earth and heavy metals resulting in soaps of the respective metals.

TABLE 5—PROPERTIES OF BAKU AND CALFORNIA TECHNICAL NAPHTHENIC OILS

	Grade—	Specific gravity @ 60° F.	Neutralization No. Mgs KOH/Gr.	Per cent unsaponifiable
Baku	Kerosene	0.95	210-270	2.0- 4.0
	Gas oil	0.96	180-200	16.0-24.0
Californian	Naphtha	0.96-0.98	285-315	1.0- 2.0
	Kerosene	0.97-0.99	235-265	2.0- 5.0
	Gas oil	0.98-0.99	165-195	4.0-18.0

Action on Metals

The naphthenic acids also easily react with most metals. Budowski[3] held 60x60x6 cm. plates of various metals each in 100 grams of gas oil naphthenic acids (Neutr. No. 158, Iodine No. 14.1) for three months at room temperature and observed the following losses:

Metal—	Loss gr./kgr.
Lead	6.10
Zinc	4.68
Copper	0.56
Tin	0.18
Iron	0.01
Aluminum	0.00
Antimony	0.11

The resistance of aluminum will be noted.

The attack is greatly accelerated at elevated temperatures which explains the considerable corrosion occurring in refinery distillation units in which naphthenic crudes are processed. Stainless steel and cast iron, especially that containing silicon, are known to resist quite well the naphthenic acid corrosion. The lower acids are more chemically active than the higher members.

Free naphthenic acids have found limited industrial application. Among them the process for reclaiming rubber suggested and patented by N. Cherchevsky[4] and the process for breaking crude oil emulsions patented by L. Berkhan[5] may be mentioned.

Naphthenates

Metals of all groups of the periodic system form naphthenates with the naphthenic acids. The metals of the alkaline group give water soluble and practically oil insoluble soaps. Sodium naphthenate, the most important member of this class, has been widely used in Europe as a cheap soap filler and as a scouring agent in the textile industry. Its value lies in the excellent lathering, emulsifying and mild detergent properties as it hydrolizes much less in water than sodium soaps of fatty acids commonly used in scouring operations. The strong odor of naphthenic acids is the main drawback of this product. However, the odor is greatly reduced when the naphthenate content of the finished soap is no more than one third. Mixtures of sodium naphthenate and carbolic acid have also been marketed as substitutes for creoline, a patented disinfectant. Spalwing[6] reported that the naphthenic acids used in his experiments were three times as effective as phenol with respect to germicidal action on cholera asiatica and Straphylococcus, but not on typhoid germs.

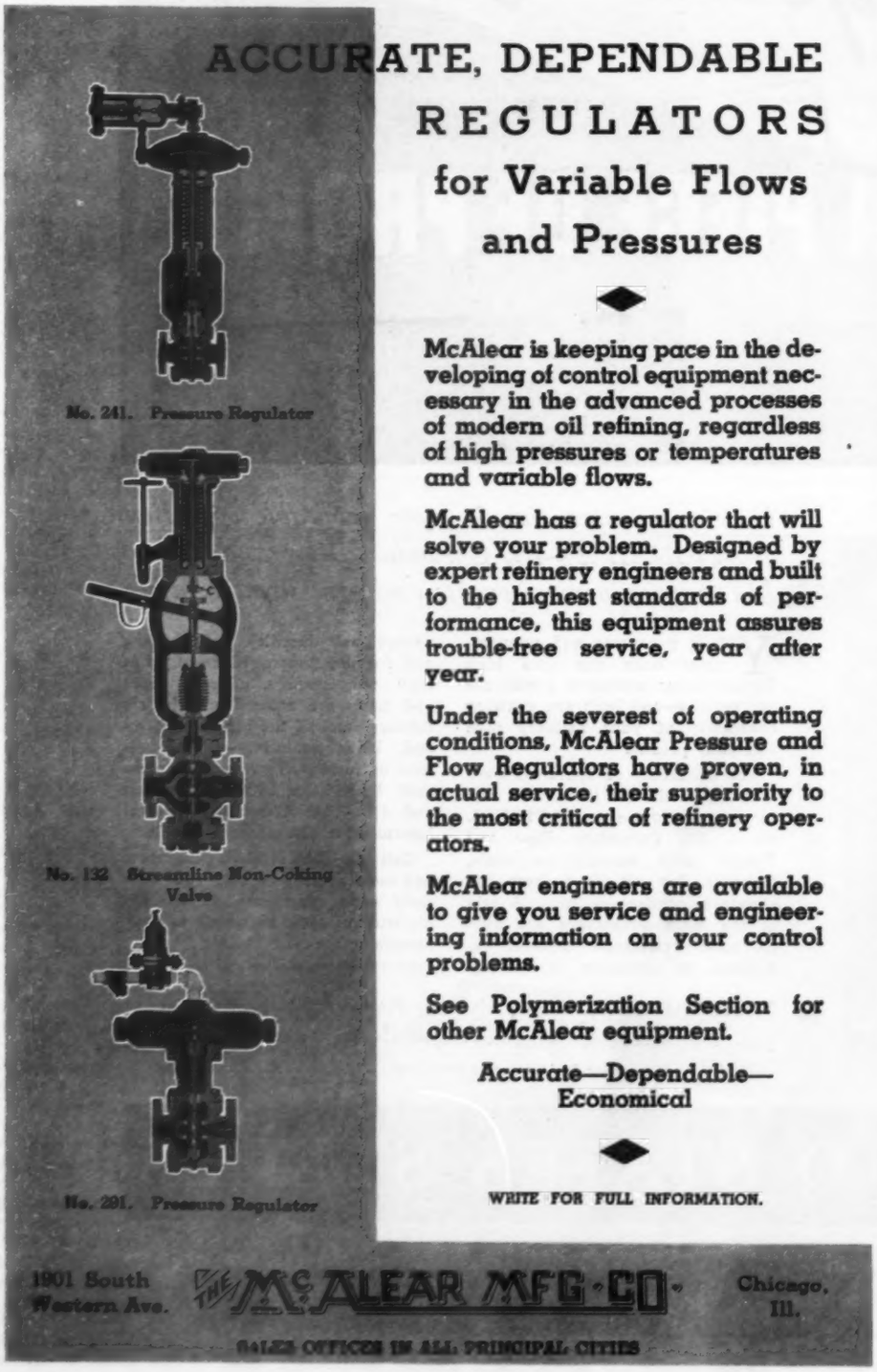
In the alkaline earth group, the calcium naphthenate has found limited use in the manufacture of cheap substitutes of boiled linseed oil and in cheap greases.

Copper Naphthenate

Copper naphthenate has been used commercially for ship-bottom paints and fish-net preservative because of its repellant and poisonous action on marine growth. Mercury naphthenates possess the same properties but no information is available on its commercial use for this purpose.

Impregnation of wood, particularly railroad ties, with copper naphthenates was suggested back in 1889 by C. Woiniewicz,[7] and later by Charichkoff,[8] but apparently the process could not compete with creosote and zinc chloride treatments.

Aluminum and lead naphthenates have been successfully used in this country and in Europe in the manufacture of special greases. Besides the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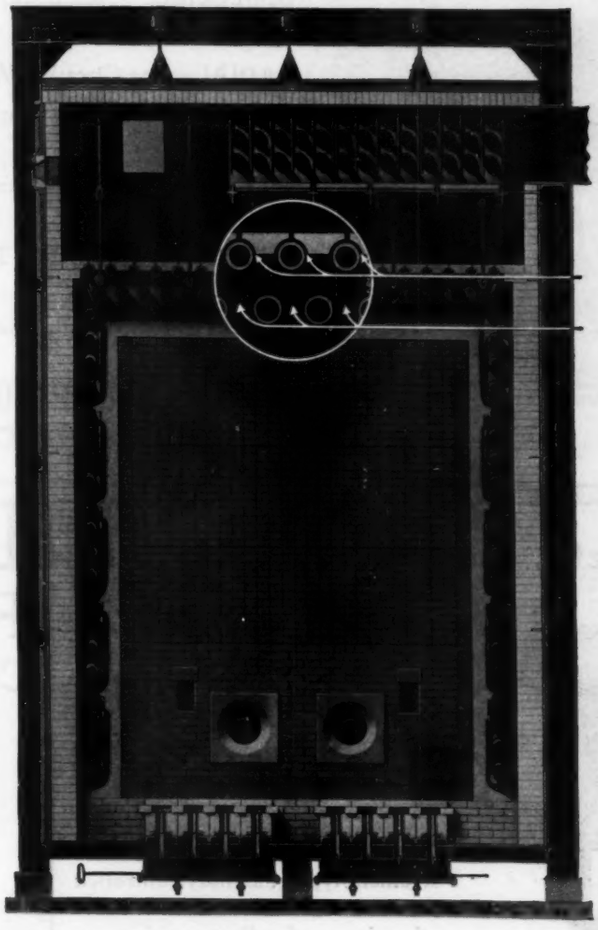

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advantage of having a source of supply of organic acids within the refinery, it has been found that the aluminum naphthenate blends with the mineral oil content of the grease better than any other aluminum soap and causes less separation in prolonged storage.

Aluminum naphthenate has been also successfully used for bodying mineral and vegetable oils where an increased ash content is not objectionable, instead of aluminum stearate and palmitate.

Lead, manganese and cobalt naphthenates and combinations thereof have outstanding merits as paint driers because of high metal carrying capacity and excellent stability of the paint blends. The naphthenates have replaced linoleates and resinates in many paint mills and the great success of the originally imported naphthenate driers gave the incentive for starting the manufacture of these products in this country three years ago.

The bulk of naphtha and kerosene naphthenic acids and their derivatives is produced from soda sludges deriving from the caustic wash of these distillates. Since the caustic wash is a routine step in the chemical refining of gasoline and kerosine, the raw materials in this case may be justly considered as by-products. In the case of gas oils the caustic soda wash is usually not a part of the refining procedure, and therefore a special extraction with caustic is made.

Since the naphthenates are excellent emulsifiers, the caustic wash of distillates oftentimes causes troublesome emulsions, especially in case of heavier fractions. Low concentrations of caustic solutions and mild agitation are commonly recommended. In more difficult cases, addition of alcohol and application of superatmospheric pressure have eliminated the formation of emulsions.

Because of the same emulsion trouble and contamination with tarry constitutents of the crude, the extraction of naphthenic acids directly from crude has not been successful, although attempts in this direction were made repeatedly.

The soda sludges deriving from precaustic wash or after-acid neutralization are essentially solutions of sodium naphthenates, but they also contain various contaminations such as emulsified oil, phenols, sulfur compounds and, in case of after-acid extractions, some sodium sulfate. Raw sodium naphthenate satisfactory for the cheap soap industry is being produced by partial evaporation of water and subsequent salting out with magnesium-free sodium chloride, or by direct evaporation to marketable water content, which usually runs between 20 and 40 per cent. Because of the fact that this soap has the consistency of a soft paste and, hence, costly drums and barrels are required, it was found advantageous to manufacture a so-called acid-naphthenate consisting of a mixture of sodium naphthenate and free naphthenic acid. This product is a viscous liquid which can be pumped and shipped in tank cars. It contains but a few per cent of absorbed water, which results in freight saving. It has an advantage over straight naphthenic acids in that it is almost noncorrosive to plain steel. Furthermore, it requires 50 per cent less acid for acidification in the process of manufacture, and 50 per cent less caustic than straight naphthenic acids for conversion into sodium naphthenate. The manufacture of acid-naphthenate consists in mixing the soda sludge with half of the amount of acid required for the complete decomposition of the sodium naphthenate content of the sludge; then, drawing off the sulfate liquor and water wash. If free naphthenic acids are required, the sludge is acidified to acid reaction and the separated acids are water washed.

The alkaline earth and heavy metal naphthenates are prepared either by double decomposition of sodium naphthenates with solutions of the respective metals, or by fusing free naphthenic acids with oxides, free carbonates and hydroxides. The latter method is commercially applied only to lead and calcium naphthenates.

The above manufacturing operations are reasonably simple as far as the production of regular grades of commercial acids and naphthenates is concerned.

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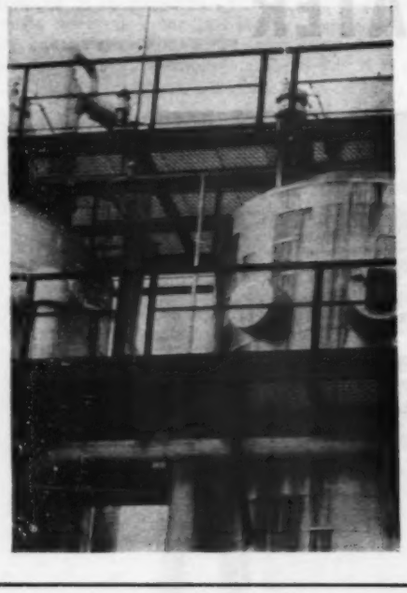
—DIAMOND GRATING—



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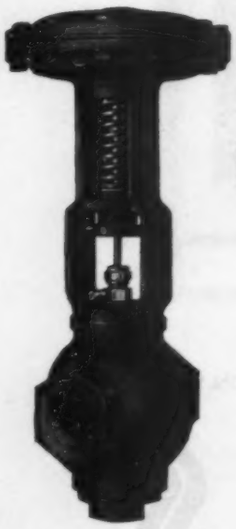

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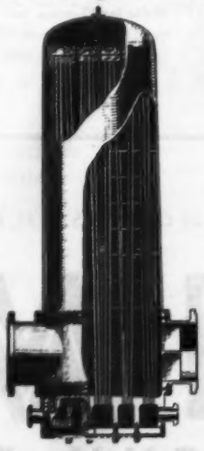

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identical with that of the solvent without acid, but resulting in a small solvent savings. Also the color of the finished lubricant is somewhat improved in the combined process.

Propane Process

The principal task of a solvent is the separation of the essentially paraffinic constituents from the nonparaffinic. However, a solvent that would do this and also eliminate the asphaltenes, carbogens, and other undesirable materials would possess greatly increased value. Such a solvent is propane which has been found to possess unusual qualities as a selective solvent in the extraction of asphaltic constituents of asphaltic or mixed-base residues, to dewax distillates or residual oils, and as a diluent in acid and clay treating solvents.

Propane is the cheapest solvent available, is nontoxic, noncorrosive, extremely stable and can be used to advantage as a refrigerant for the complete removal of wax. It owes its versility as a solvent to the fact that its properties change very rapidly between —44° F. and +215° F. At its lower temperatures propane acts as a dewaxing agent and its value as such is mainly due to (1) its very low solvent power for wax at these temperatures, (2) its low viscosity and (3) its extremely valuable property of self-refrigeration. At temperatures over approximately 70° F. propane is used as a preferential precipitant and in general it has been found that heavier components are thrown out of solution first, but as the physical properties of propane become more those of a gas it dissolves less and less oil until at 212.2° F., the critical temperature of propane, no viscous oil remains in solution.[1] Propane also has been found to increase the solvent selectivity and efficiency when used in conjunction with other selective solvents.

The propane process of solvent refining offers a method of continuous operation with relatively simple equipment. By mixing the required amount of propane with the residuum at the proper temperature and then allowing the mixture to separate, two phases are formed with the propane phase containing the desired lube oils. After deasphalting, by employing the refrigerating properties of propane, the oil may be dewaxed.

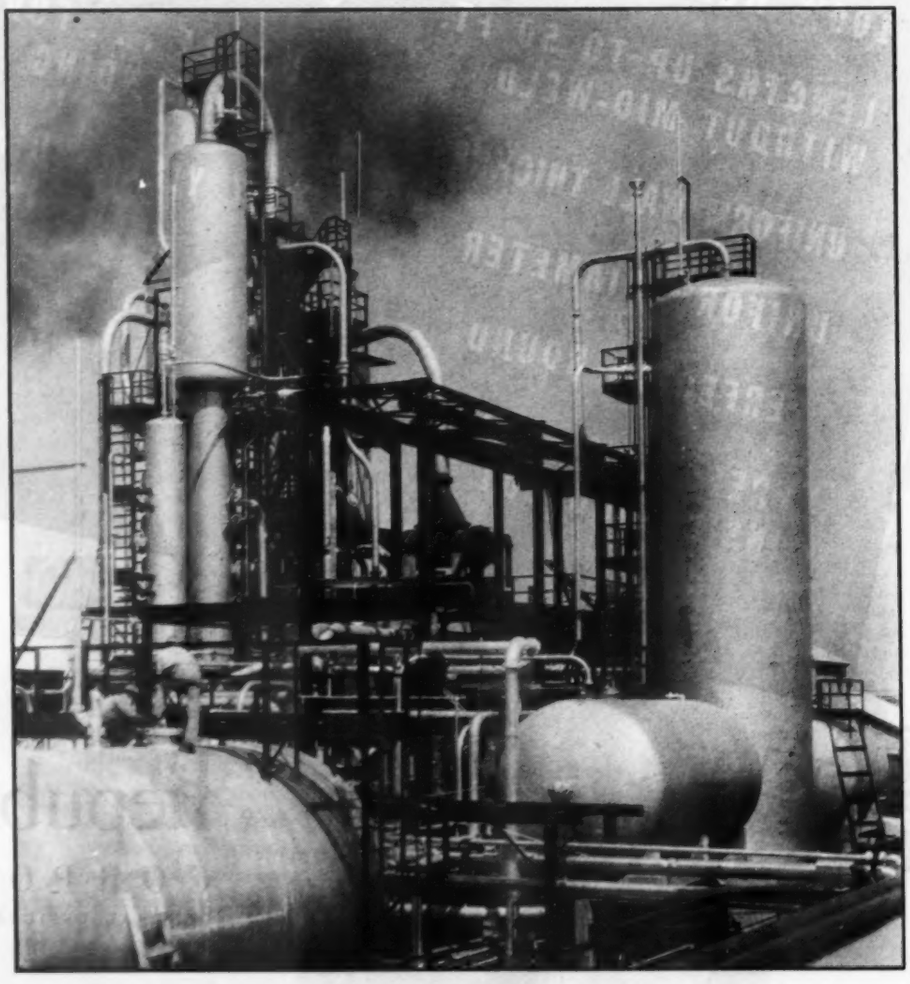
Like propane, acetone-benzol is used as a dewaxing agent, the process consisting of mixing the charged oil with the solvent, chilling the mixture to the desired operating temperature and then passing the mixture through a filter. The wax with some solvent remains on the leaf while the wax-free oil containing most of the solvent passes through the filter. The solvent is then recovered from both the wax and the finished oil for reuse. Any water present in the original charge appears in the wax cake and may be separated by decantation after passing through the wash solvent exchangers.

The solvent used in this process is in reality a mixture of acetone, benzol and toluol.[5] In commercial practice the acetone fraction varies from 25 to 35 per cent and toluol from 12 to 25 per cent, the remainder being made up by benzol. More paraffinic oils require lower acetone fractions while the lower operating temperatures require the higher combined fractions of toluol and acetone. Benzol is used as the solvent for the oil, although toluol is equally suited for this purpose while acetone acts as a precipitant for the wax and an antifreeze for the benzol.

This method of dewaxing oils differs from the processes involving centrifuging and cold settling operations in that the oil-solvent mixture can be continuously chilled at a fairly high cooling rate, whereas these methods require slow chilling. Also the differential between the chilling temperature and the desired pourpoint of the finished oil is small thus eliminating the necessity of chilling the oil mixture to a very low temperature to make oils of moderate pour. In commercial practice the oil-solvent mix is usually chilled to about 5° F. above the desired pourpoint.

Furfural Process

Extensive research has revealed that furfural, chemically designated as furfuraldehyde, fulfilled the requirements of a superior selective solvent. It is adaptable to countercurrent operations, is available in large quantities at low cost, is easily recovered from the raffinate and extract phases, and is applicable to high viscosity oils at temperatures high enough to obtain intimate contact and rapid separation of the extract and raffinate fractions.



Multi-Sol plant No. 2 (furfural solvent extraction unit) at the Port Arthur, Tex., refinery of the Gulf Oil Corporation of Pennsylvania, recently put into full operation

Furfural is also well adapted to use in packed counterflow extraction towers.[6] The high operating temperature and the difference in specific gravity of the two fractions making the application possible. Also the high temperature of application insures a low viscosity in the oil phase and a low resistance to attainment of equilibrium. However, the process is equally adaptable to either counterflow towers or step-counterflow operations, the choice depending on economics involved and the degree of flexibility desired.

The main operating units of the furfural process as it is applied in one refinery are as follows: "(1) A vertical counterflow extraction tower with preheaters and exchangers for furfural and oil charge. (2) Extract stripping unit for two-stage dry distillation of furfural from extract solution followed by steam stripping under vacuum for removal of final traces of solvent. (3) Refined oil stripping unit for vacuum distillation of furfural from the refined oil solution followed by steam stripping under vacuum for removal of final traces of solvent. (4) A solvent-recovery system for recovery of furfural from water."

One advantage to be derived from the use of furfural as a solvent is found in the fact that it possesses a very low toxicity. Further advantages are that a wide range of temperatures is possible and it is applicable to both distillates and residual oils of varying types. Laboratory and confirming mechanical tests show furfural refined oils to give very little carbon deposition, resist sludge formation and show but little change in viscosity with service.

Sulfur Dioxide Method

In 1919 Edeleanu and his co-workers developed the first successful solvent treating process on a commercial basis, employing liquid sulfur dioxide as the solvent. However, its initial application was limited to the treating of lighter fractions such as kerosene and gasoline. Associated Oil Co. in 1925 constructed the first Edeleanu SO_2 in America at its Avon, Calif., refinery.

The method operates on the basis of the difference in solubility in liquid SO_2 at varying temperatures of the various desirable and undesirable constituents of the raw lube distillate At reasonably low temperatures, 10° C., the higher boiling paraffins, naphthenes and naphthenic acids are insoluble while the aromatics and unsaturated hydrocarbons are miscible at all temperatures and in all proportions. When the method was first applied to the heavier lubricating oil fractions it did not yield the desired quality of raffinate so that it was modified by employing a mixed solvent consisting of liquid SO_2 and benzol.

The physical properties of the finished oil resulting from this process are greatly improved. A considerable increase in gravity is obtained. The Conradson carbon and sludge values are reduced and a flatter viscosity curve is obtained. An economical saving is effected by the fact that the residue resulting from the process may be used as fuel oil. The process is adaptable to a continuous semiautomatic method of operation, and it is applicable to any type of charging stock. The solvent employed is cheap, practically noncorrosive under the conditions of operation, and is easily recoverable.

The 8-N (Separator-Nobel Co.) process is another dewaxing process which employs trichloroethylene as the solvent medium. The process is characterized by the special design of the con-

trifuge used for removing the precipitated wax. The process is similar to the naphtha centrifugal method with the exception that the centrifuge has a special bowl which permits the discharge of petrolatum from the center of the bowl and the bright stock from the periphery.

In actual operation the trichloroethylene is preheated to about 120° F., mixed with the oil and allowed to cool to about the pourpoint of the mixture. The capacity of the chilling equipment should be such as to allow the chilling rate to be about 12° F. per hour. The mixture is taken from the chiller directly to the S-N centrifuge which is completely encased, and exhaust steam used to melt the petrolatum. Solvent reclamation is accomplished by distillation.

Advantages of the S-N process are that the solvent is inflammable, can be stored under water to prevent evaporation losses since it is not miscible with the latter and it does not hydrolize. Low boiling point and low specific and latent heats render the distillation of the solvent from the separated oil and wax an easy and inexpensive operation. The solvent dissolves asphaltic bodies present in the oil, transferring them into a noninhibitor state so that asphaltic residues can be dewaxed without previous detarring.

Phenol Process

While some of the principles involved in the phenol process are similar to those of the Edeleanu process, it differs in the respect that the raffinate is distilled from the mixture of distillate and solvent. The charging stock is agitated with the proper amount of phenol at a temperature slightly higher than the crystallization point of the latter. After allowing to stand for a while two layers form, the heavier layer containing the solvent and solute and the lighter layer the raffinate with some of the phenol in solution.

Important factors having a bearing on the improvement of the raffinate are: Proportion of phenol to oil, contacting method and treating temperature. By increasing the temperature a better grade of raffinate results but the yield decreases. A similar effect is obtained by increasing the proportion of phenol to oil.

An improvement in the following properties of the lubricating oil has been found to result from the phenol process of treating distillates; an increase in viscosity index, and improvement in gravity, color stability and a lowering in the sulfur compounds and carbon residue.

When night comes in Port Arthur, Tex., the new Multi-Sol (furfural) extraction plant of the Gulf Oil Corporation of Pennsylvania may be seen as a mass of lights

The nitrobenzene process like other extraction processes consists of mixing the charging stock with the proper amount of nitrobenzene at the desirable temperature to produce optimum results. The process is adaptable to both the countercurrent and batch methods of extraction and may be used on a wide range of charging stocks whether paraffinic or naphthenic, overhead or residuum. Also the process may be applied before or after the dewaxing treatment. Lubes made by this process have a high V.I., high chemical stability and low Conradson carbon value. A thorough description of this process is given by Stines in a following article of this issue.

Benzol Methyl-Ethyl Ketone

During the past year the Gulf Oil Corp. of Pennsylvania installed a large solvent extracting plant in its Port Arthur refinery, photographs of which are shown in this section, using benzol-methyl ethyl ketone as the solvent extracting medium. The properties of methyl-ethyl ketone are similar to those of acetone and is used as a dewaxing agent in place of acetone. Like acetone, methyl-ethyl ketone is not toxic under the conditions of plant operation.

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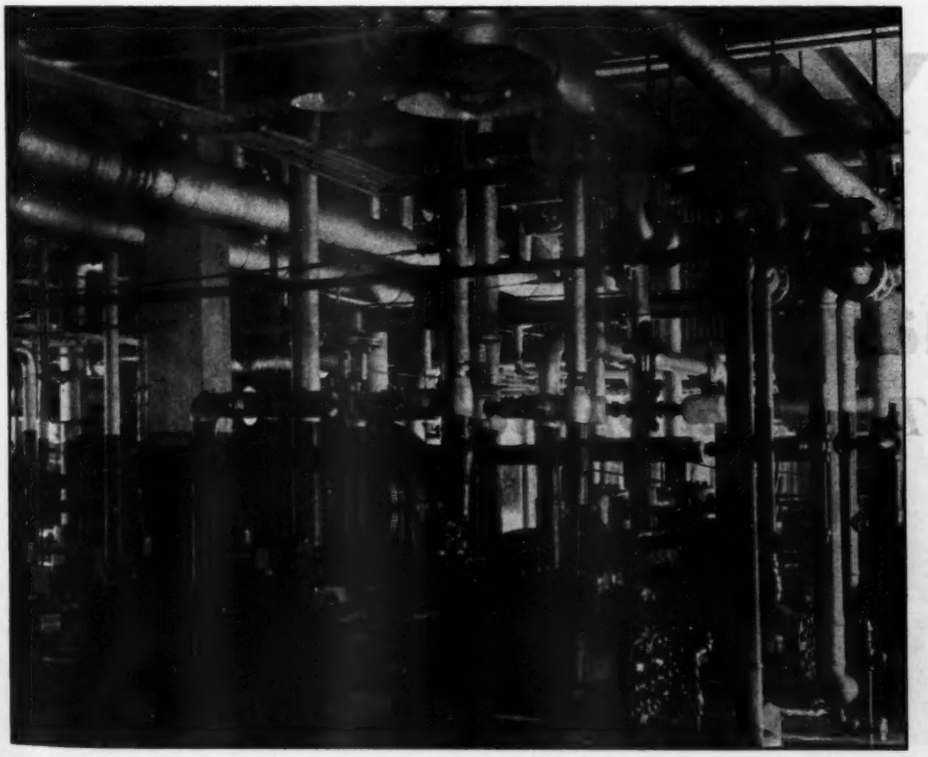

Pump room in the new Port Arthur, Tex., benzol methyl-ethyl ketone solvent dewaxing unit of the Gulf Oil Corporation of Pennsylvania

Elements of Diesel Engineering

During the past few years there has been a marked increase in the use of diesel engines in many departments of the petroleum industry. Pumps driven by diesel engines have been recognized as well suited for oil pipe line stations for years and more recently diesel engines have been used as prime movers for drilling rigs either through direct connecting to drawworks and slush pump or by connecting the engine to a direct current generator and delivering the power so produced to motors at the drawworks and slush pumps.

The increasing interest in diesel engines in all branches of industry has been noted in recent years and information on the general subject is of interest to many in the petroleum and in other industries. Orville Adams, consulting diesel engineer, Dallas, Tex., has been specializing in the use of diesel power for the past 20 years and recognizing this increased interest has edited a book entitled "Elements of Diesel Engineering" covering this general subject in a very complete manner.

This book should be of particular interest to the man who desires to learn more about internal combustion engines and particularly about diesel type with the idea of preparing himself to later become an engineer in this branch of industry. There are 20 chapters in the book, which contains nearly 500 pages and is well illustrated. At the end of each chapter there are questions and answers arranged for review reading and study. The book can be used as a text book and for either home study or in the class room will find a definite place.

This book is published by The Norman W. Hanley Publishing Co., 2 West Forty-fifth Street, New York City, and sells for $4 per copy.

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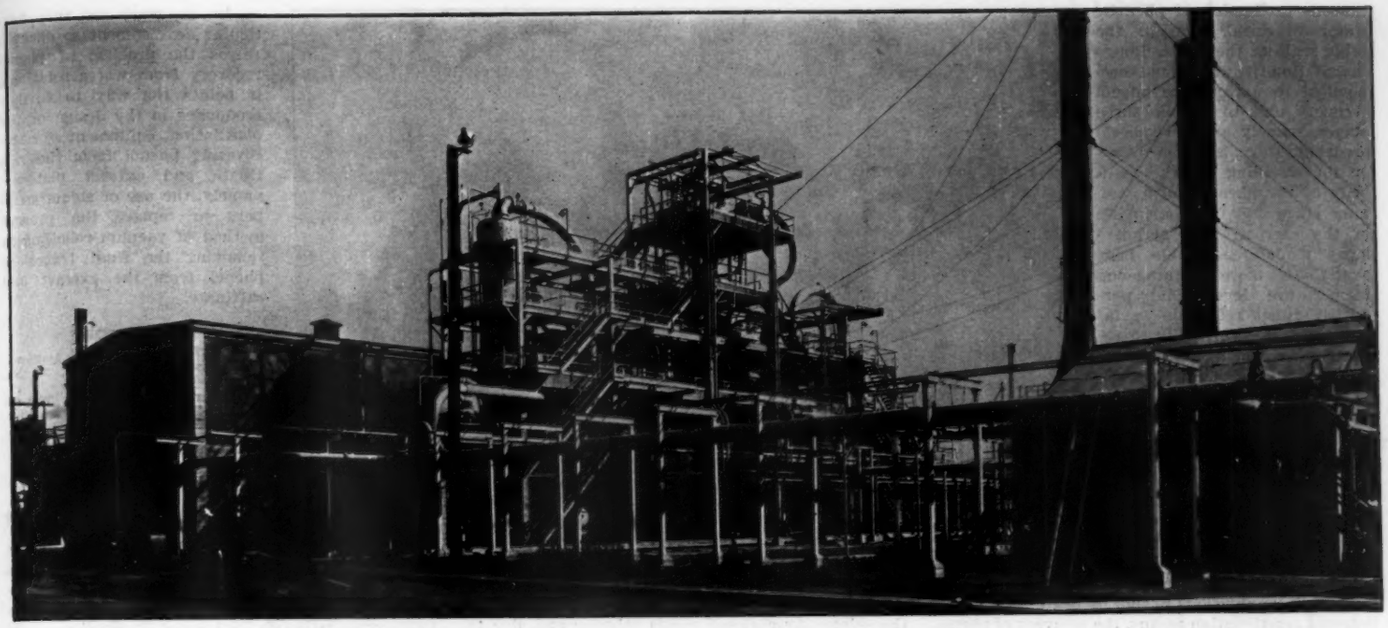


General view of phenol plant at the Baton Rouge, La., refinery of the Standard Oil Company of Louisiana

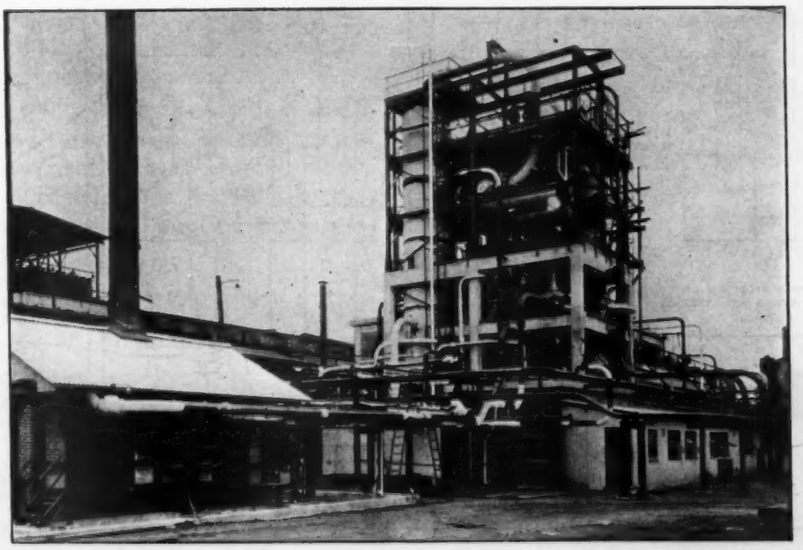
Some Recent Trends in Phenol Plant Design and Operation

By D. E. STINES
Standard Oil Development Co.

As in other instances in the process industries, the effect of increasing application of a process to stimulating design methods and laboratory research toward improved technique is seen in the more recent developments in the phenol extraction process for treatment of lubricating oils. Some of these features are illustrated in the latest installations at the Bayonne plant of the Standard Oil Co. of New Jersey, and the Baton Rouge plant of the Standard Oil Co. of Louisiana, both of which plants went on production during the past 18 months. Further developments in the past year, however, particularly in connection with the extraction step and the method of handling phenolic water indicate that a new installation today would outmode even the latest plants in many respects. Previous articles (1 and 2) have described the phenol process in detail, with particular reference to the Sarnia installation of the Imperial Oil, Ltd., and the Port Jerome installation of the "Standard Franco-Americaine de Raffinage."

The Bayonne plant was the first installation to employ centrifuges in affecting the interstage separation of the phenol and oil phases in the countercurrent extraction step. This application permitted increased flexibility in handling a number of feed stocks and in changing readily from one feed stock to another, due to the reduced quantity of oil and phenol held up in the treating unit. The attendant reduction in phenol inventory likewise aided materially in making the installation economically feasible, particularly for smaller size plants.

In the Baton Rouge plant, interstage separation of phases is effected in shallow pan type settlers since capacity considerations made a centrifuge installation less desirable in this case. The use of an adjustable weir arrangement for controlling the location of the phenol-oil interface in the settler, as first applied in the Port Jerome phenol plant, demonstrated the possibility of close interface control by this means. Advantage was taken of this point in the Baton Rouge settler design by reducing the pan depth to one-third of the minimum previously employed. This simple change alone effected important economies in settler construction cost and phenol inventory. Meanwhile, laboratory and semiplant scale experiments have been directed toward developing a countercurrent tower type of extraction unit, in as much as further economies could be effected by this method of carrying out the extraction step. The results of this work have been very promising and it is indicated that future installations will no doubt incorporate the use of the countercurrent tower extractor.



General view of phenol unit at the Bayonne, N. J., refinery of the Standard Oil Company of New Jersey now in full routine operation

In the installations previous to the Baton Rouge plant the recovery of phenol from the spent phenol or extract phase was carried out in two stages, atmospheric and vacuum, with water elimination accomplished by side stream withdrawal of the recovered phenol from the atmospheric tower and simul-

taneous production of phenolic water overhead. Due to the large scale of the Baton Rouge installation it was found economical to expand the phenol recovery unit to include three stages, namely an atmospheric predrying stage, a pressure tower for distilling off the main body of the phenol and a vacuum stage for final stripping of the extract. This arrangement made recoverable heat available at more advantageous temperature levels and permitted a net reduction in investment due principally to reduced exchanger surface requirements. In addition, the separate "drying tower" permitted more flexible control of the water elimination step.

Centrifuge room of the Bayonne phenol plant

In treating with anhydrous phenol, the problem of moisture content control presents some interesting aspects due to the formation of a constant boiling mixture between water and phenol. Although no difficulties are encountered in maintaining anhydrous phenol by ordinary distillation and fractionation means, the recovery of phenol from the constant boiling phenolic water produced requires special treatment.

Early Methods

In the earlier plants, the recovery of phenol from phenolic water had been accomplished by the salting out method in a batch operation employing sodium chloride. This method has the inherent disadvantages of discontinuous operation and high labor charges. In the Baton Rouge design, a continuous salting out unit was developed, employing calcium chloride. In the operation of this unit, a concentrated salt solution is circulated through a stripping tower and phenolic water feed introduced on the top plate. Heat is supplied at the bottom of the column by a closed steam reboiler and, due to the effect of the dissolved salt in altering the volatility relationship of phenol and water, a concentrated phenolic water product is distilled overhead and substantially phenol-free water vapor with the miscibility relationship of phenol and water, separates into two phases consisting of water-saturated phenol and phenolic water, both of which are recycled for final drying and water elimination. This type of unit represents an improvement over the batch salting out procedure, but still further improvement in phenolic water recovery can be effected by the use of an absorption type of unit.

In as much as this particular development so cheaply solves the problem of phenol recovery from water solutions, it points the way to further economies in the design of the distillation equipment for recovering phenol from the raffinate and extract phases—namely, the use of steam strippers to replace the present method of vacuum reboiling in removing the final traces of phenol from the extract and raffinate.

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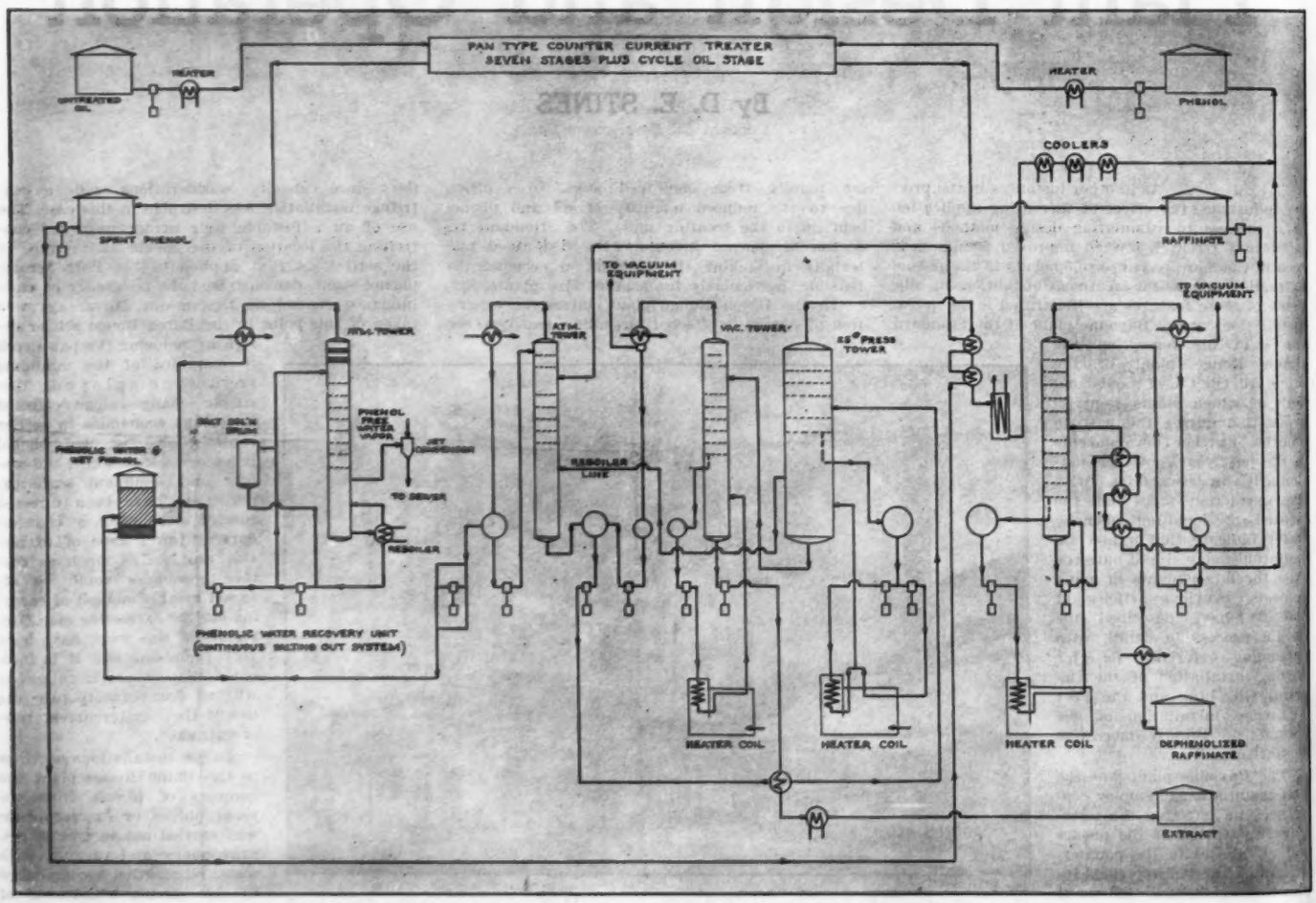
A.P.I. Meeting at Shreveport

R. D. Risser, Shell Petroleum Corp., Iowa, La., has been appointed chairman of the program committee for the spring meeting of the American Petroleum Institute's Division of Production Southwestern District scheduled for April 9 and 10 at Shreveport, La., in the Washington-Youree Hotel.

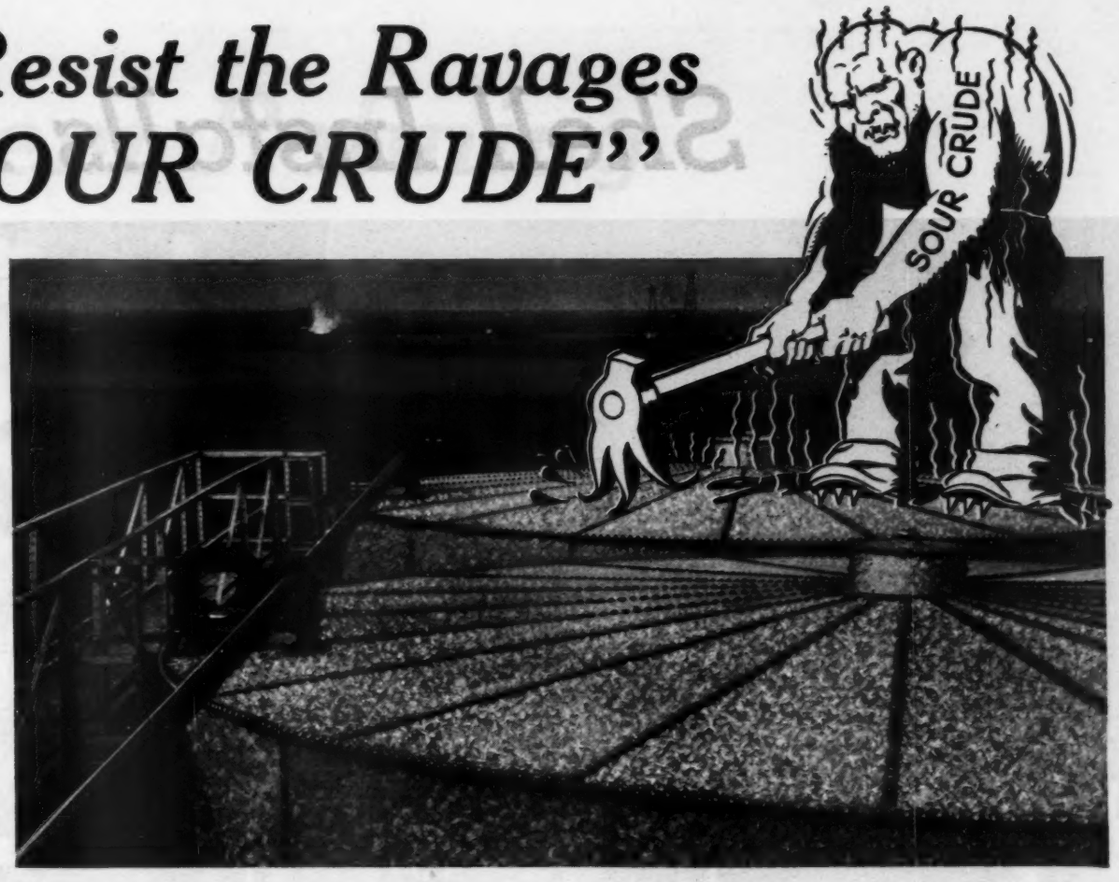
The Rodessa oil field, pumping installations, characteristics of producing sands, salt domes, geological investigations, diesel-engine drilling rigs, oil field safety, and rotary rigs will be among the subjects discussed.

Other members of the program committee are: G. B. Corless, Humble Oil & Refining Co., Houston, Tex.; Harvey Hardison, California Co., Midland, Tex.; W. F. Knode, Corpus Christi, Tex.; G. I. McBride, Shreveport, and Carl Reistle, East Texas Engineers Association, Kilgore, Tex.



Flow chart of the Baton Rouge phenol plant of the Standard Oil Company of Louisiana

They Resist the Ravages of "SOUR CRUDE"



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But why use ordinary tanks in sour crude districts? COLUMBIAN SPECIAL GALVANIZED TANKS whip "Sour Crude" to a standstill. Their heavy coating of zinc spelter resists the ravages of "Sour Crude". This special zinc spelter coating is applied by the Columbian exclusive galvanizing process in such a manner as to guarantee tight adhesion.

Other features of these tanks are: Special exclusive process used in preparation of the metal sheets — Special fabrication which does not destroy or render inefficient the galvanized coating — Sheets of selected base metal.

Columbian Special Galvanized Tanks are built to A. P. I. specifications. They have been tested and proved successful. For instance: A battery of eight of these tanks, after two years' service in a Wyoming sour crude district, are as good as the day they were installed. Another battery in a West Texas area, where ordinary tanks failed in 6 to 8 months, is still in successful use after three years' service.

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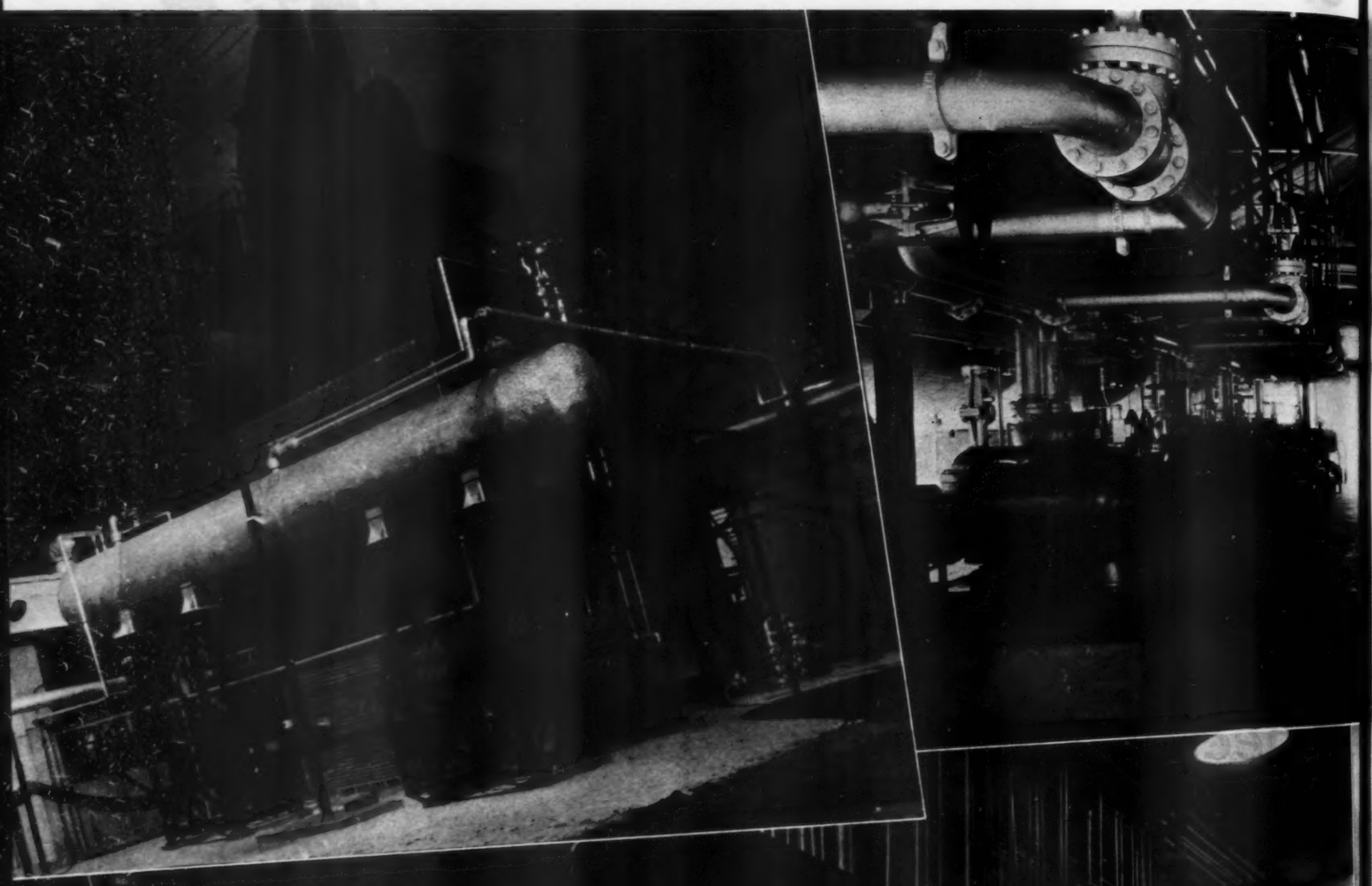
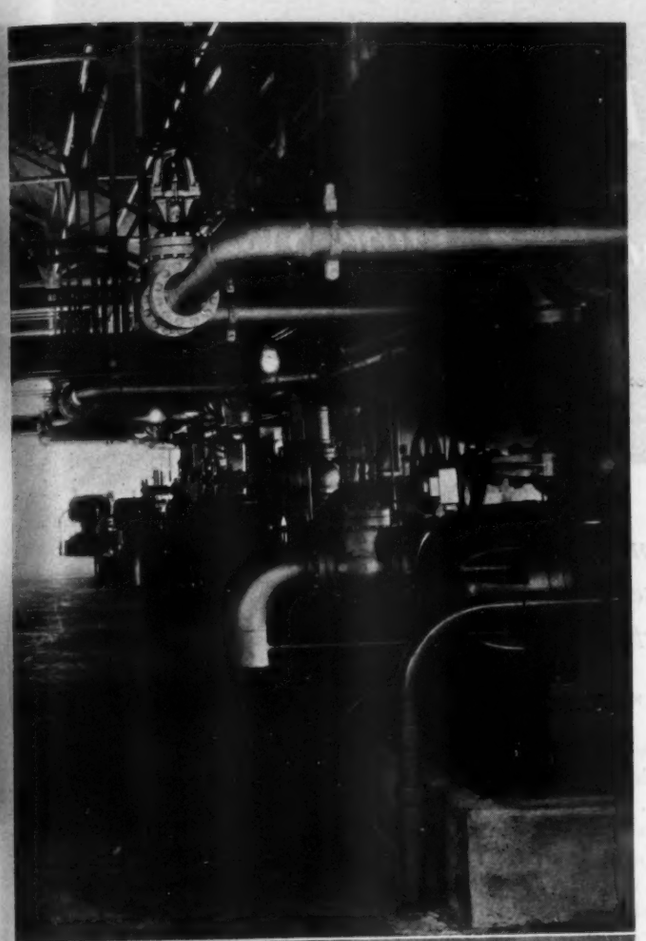
● See pages 385, 386, 387, and 388 in the 1936 Composite Catalog.

Shell Installs Large



Solvent Refining Plant



At its Wood River, Ill., refinery Shell has just completed the largest solvent refining and dewaxing unit in the Middle West. In the picture in the upper left is shown the high pressure still used to recover the solvent. The picture to the right shows the interior of the pump house as part of the solvent refining unit. In the lower left corner is shown a panel board holding the control and recording instruments that guide the operation of the solvent refining unit. Below is the general exterior of the Shell's new solvent refining unit. In the foreground are the various exchangers and in the rear the contact towers. The new unit will produce about 2,000 barrels of solvent refined motor oils and industrial lubricants daily. The installation of the solvent refining and the solvent dewaxing plants were undertaken simultaneously about one year ago along with a general rehabilitation program for the plant. This program is nearing completion, the two solvent units having been in routine operation several months and are now producing a substantial part of the total lubricating oil output of the refinery.

TEMPERATURE CHANGES TRANSMITTED

6 TIMES FASTER

with New Taylor Thermospeed Tube System . . .

New Separable Well Tube System construction many times more sensitive than conventional types . . . overcomes sluggish and lagging response and reduces bulb conduction error

A SEPARABLE WELL Tube System with a rate of response to temperature changes that closely equals that of a fast-acting, bare bulb system.

This is the latest contribution of Taylor Engineers to more accurate temperature measurement and control. And one of the most important.

The Taylor Thermospeed Tube System overcomes the sluggish action common to previous Separable Well Systems. It enables Taylor Recording Thermometers to show a true and accurate picture of temperature at the bulb—and do it on the dot. It causes control valve corrections to be made at the slightest tendency to depart from the control point. It enables Taylor Controllers to give much closer regulation, especially where rapid temperature changes occur.

Remember this point, too: The Taylor Thermospeed construction assures more accurate control by greatly reducing bulb conduction error. Variations in the temperature of the bulb mounting or supporting wall do not change the bulb temperature. Another disadvantage of previous separable well systems overcome at last!

The graph indicates how much faster Thermospeed is in response than other types of separable well instruments. Let us demonstrate how this new Taylor development can modernize and sharpen temperature control wherever separable wells are necessary. This service is available from a Taylor Representative. Or can be obtained by writing to Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada. Manufacturers in Great Britain—Short & Mason, Ltd., London, Eng.

New Taylor Thermospeed construction (separable well and bulb) shown with Taylor Fulscope Controller.

PASS IN REVIEW

Here are just a few of the developments that have come to industry from Taylor Engineers within a comparatively short time:

Accuratus Tubing, which has made Taylor mercury-actuated tube systems applicable almost anywhere.

"Fulscope" Recording Controllers with the Universal Sensitivity-Adjuster.

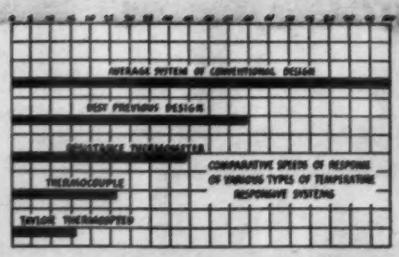
"Dubl-Response" Control, which assures accurate load compensation and Precision Valve Action.

"Valve-Precisor," a separate precision-valve-action unit to modernize control valves now in operation.

And the *"Thermospeed"* Separable Well Tube System described here.

Let Taylor Engineers find the answers to your temperature problems and needs.

Showing the comparative rates of response of various temperature measuring devices plotted to an arbitrary time scale. Comparisons were made with the sensitive elements in standard wells and in a thoroughly agitated water bath. In response to the same temperature change, the THERMOSPEED is six times faster than the average conventional tube system; about three times faster than a resistance thermometer; and almost twice as fast as a thermocouple.


AVERAGE SYSTEM OF CONVENTIONAL DESIGN
BEST PREVIOUS DESIGN
RESISTANCE THERMOMETER
THERMOCOUPLE
COMPARATIVE SPEEDS OF RESPONSE OF VARIOUS TYPES OF TEMPERATURE RESPONSIVE SYSTEMS
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TEMPERATURE, PRESSURE *and* FLOW INSTRUMENTS

Superior Lubricants Via the Nitrobenzene Process

By W. A. MYERS

Chemical Engineer, Research and Development Dept. The Atlantic Refining Co.

There exists at the present time an ever-increasing demand on the part of the consuming public, the motorists, for better performance from their motor cars and for greater economy of operation as well. The manufacturers of motor cars have answered this demand by continually improving design. These changes in design have been in the direction of higher speeds, higher compression ratios, and higher bearing pressures. To obtain satisfactory operation of such cars a superior lubricant is required. This lubricant must provide for cold weather starting, warm weather operation, long life for lubricated parts with attendant low repair bills and low consumption. These results can only be attained with a lubricant capable of continuously maintaining a film of oil between the surfaces of all moving parts regardless of speed, pressure, or temperatures over the range set by year-round driving in a wide variety of climates. In addition the lubricant, even though infrequently changed, must remain free of sludge.

Expressed in terms of oil characteristics, this means a demand for a lubricant showing a small change in viscosity with temperature, a low pourpoint, a low carbon residue, a high film strength and good chemical stability.

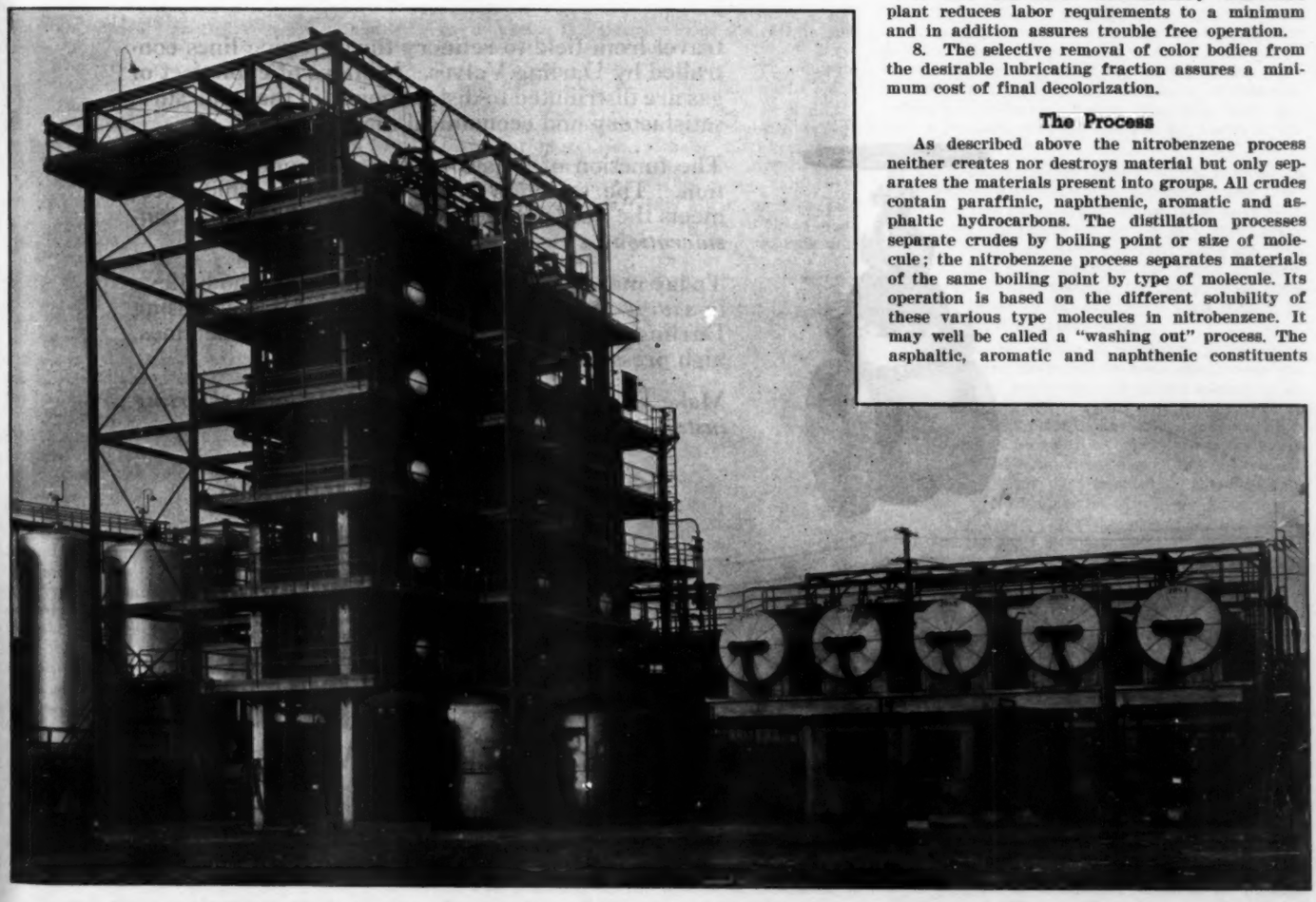
The petroleum refiner is faced today with a difficult problem. To meet the demand for superior lubricants he must make lubricating oils having a high viscosity index or low viscosity-gravity constant, a low pourpoint, a low carbon residue, an ability to withstand high bearing pressures, and a stability to withstand long use in the engine without the formation of sludge and acid bodies. At the same time he faces the necessity of producing these oils at a low cost. In addition to these factors he must be able to accomplish the result without changing the whole refinery balance in order to obtain special crudes or some special distillate cuts from his present supply.

The nitrobenzene process offers an excellent solution to this problem. It is a "separation process" which can be applied to either distillates or residuums from any crude. When this process is used lubricants having a high viscosity index, low carbon residue and good chemical stability can be separated from any stock which contains these lubricants. This has been done on distillates and residuums from Pennsylvania crude, Mid-Continent crude and coastal crude. Low pourpoint is obtained by any chosen dewaxing process. Since hydrocarbon oils do not have high film strength, nitrobenzene treatment does not affect this property. This characteristic can only be obtained by the addition of a material having E.P. properties. These superior lubricants can be produced at a low cost by the use of nitrobenzene because of eight factors favorable to the process.

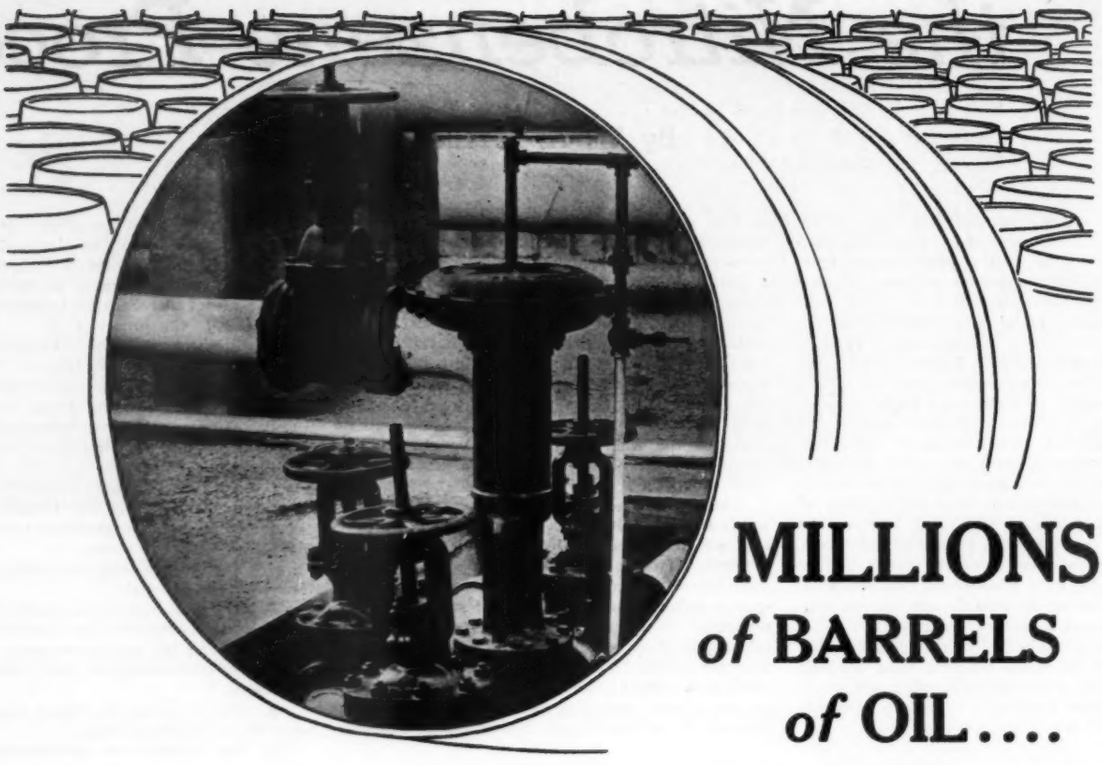
1. Low consumption of utilities (steam, power and water) is assured because the low solvent ratios employed reduce these items, incident to solvent recovery by distillation, to a minimum.
2. No preliminary preparation of the stock, such as special distillation or acid treatment is required.
3. No degradation of product to sludge or like material results from the process. The products combined in yield proportions produce a material identical with the stock.
4. The economically maximum yield of superior lubricants is assured.
5. The first cost of the plant is low, as dictated by low temperatures, low pressures, continuous operation and the lack of necessity for any special materials, of construction since nitrobenzene is not corrosive.
6. The same factors which make for low first cost fix a low repair rate.
7. The continuous automatically controlled plant reduces labor requirements to a minimum and in addition assures trouble free operation.
8. The selective removal of color bodies from the desirable lubricating fraction assures a minimum cost of final decolorization.

The Process

As described above the nitrobenzene process neither creates nor destroys material but only separates the materials present into groups. All crudes contain paraffinic, naphthenic, aromatic and asphaltic hydrocarbons. The distillation processes separate crudes by boiling point or size of molecule; the nitrobenzene process separates materials of the same boiling point by type of molecule. Its operation is based on the different solubility of these various type molecules in nitrobenzene. It may well be called a "washing out" process. The asphaltic, aromatic and naphthenic constituents



General view (Figure 7) of nitrobenzene extraction equipment at the Philadelphia plant of the Atlantic Refining Company



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along with the color bodies are selectively dissolved in the nitrobenzene. The desirable paraffinic material is left behind. This process is progressive in that the material washed out first is the least desirable fraction. This then allows the refiner to stop the treatment at any desired quality of product remaining. The material washed out is called the extract and the material remaining undissolved is called the raffinate or refined material.

The extract is best described by considering its physical properties relative to the charge stock.

1. The A.P.I. gravity is 10-15° lower than the charge.
2. The viscosity at 210° F. is higher than the charge.
3. The viscosity-gravity constant is .04-.10 higher than the charge.
4. The viscosity index is 10-100 points lower than the charge.
5. The carbon residue is much higher than the charge.
6. The color bodies are largely concentrated in the extract.
7. The naphthenic acids are largely concentrated in the extract.
8. The boiling point, flash and fire are the same as the charge.

The raffinate may be described in a similar manner.

1. The A.P.I. gravity is 1-10° higher than the charge.
2. The viscosity at 210° F. is lower than the charge.
3. The viscosity-gravity constant is .01-.09 points lower than the charge.
4. The viscosity index is 5-100 points higher than the charge.
5. The carbon residue is .5 to 5 per cent lower than the charge.
6. The color concentration is 10-40 per cent of that in the charge.
7. The acidity is invariably low regardless of the charge.
8. The pourpoint is higher than the charge since wax is concentrated here.
9. The boiling point, flash and fire are the same as the charge.

The raffinate is not yet a finished oil. It requires dewaxing, if this has not been done previous to nitrobenzene treatment, and a final clay treatment. However, no acid treatment is required.

When these operations have been completed we have a superior lubricant. Figure 1 illustrates the chemical stability of these oils as judged by laboratory tests. The sludge formation is very slight even after long hours of exposure and hence we have shown here a more delicate test, the increase in viscosity with time under oxidizing conditions. A Pennsylvania oil is shown for comparison.

However, at best, laboratory tests are not as conclusive as actual tests on engines in daily use. Accordingly, a road test was undertaken to verify the laboratory results obtained on the oil produced by this process. Six cars, in the low price bracket, were driven by amateur drivers over the highway at an average speed of 40 miles per hour for 100,000 miles each, using these oils. Figure 2 shows the average consumption of oil for the complete tests. The low rate of oil consumption, even at the end of the test, is a clear indication of how well the piston and cylinder walls were lubricated. The oils used were a part of the 500,000-bbl. production of nitrobenzene processed oil. The low wear experienced in the test was due to the high film strength of these oils, a property independent of nitrobenzene treatment.

Figure 3 shows a photograph of the cylinder block of one of the cars which took part in the test. The absence of heavy carbon deposits after 100,000 miles of operation without carbon removal is a noteworthy achievement and further illustrates the high quality of these nitrobenzene processed oils.

The chemical stability of the oil in service is an important quality. If the oil forms sludge in service, this material will result in plugged oil passages, sticking rings and other highly undesirable effects. Consider Figure 4 which shows a typical crankcase taken from one of the cars in this test at the end of 100,000 miles. It had never been removed or cleaned in any way. This demonstrates the remarkable stability attainable by nitrobenzene extraction.

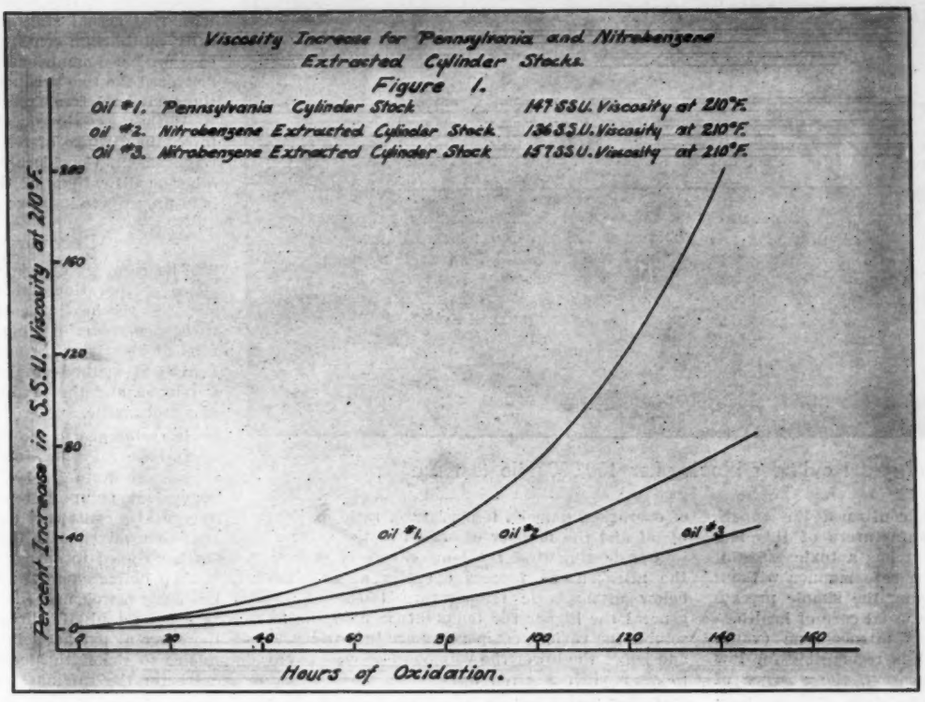
The production of these superior lubricants does not entail special stocks when the nitrobenzene process is used. The various crudes differ largely in the amount of superior lubricating oil which they contain but practically all of them contain some of this material. Hence, it is possible to make these superior lubricants from any crude source which contains them. Likewise nitrobenzene is effective on either a distillate or residuum. It should be remembered, however, that there are some stocks not economically suited to solvent processing.

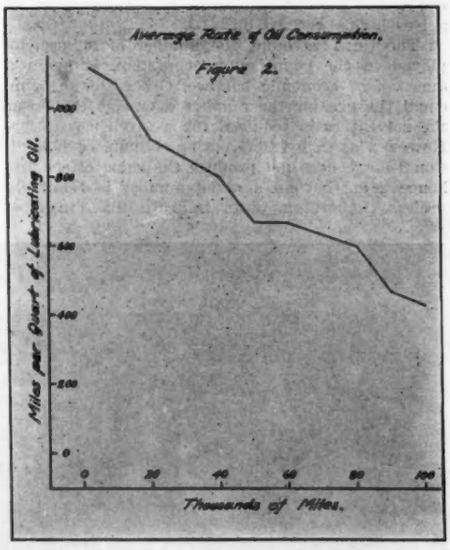
The flexibility of the process is illustrated in the table Figure 5. This shows the results obtained on 10 different stocks covering the crude range from Pennsylvania, through Mid-Continent to the coastal type and the viscosity range from 175 S.S.U. at 100° F. to 950 S.S.U. at 210° F. It will be noted that the raffinate yields obtained are high in the case of Pennsylvania type oils and progressively lower through the Mid-Continent grade oils to the coastal type. This is a function of the composition of the charge stock and is further affected by the quality of raffinate desired and the conditions of operation. The raffinates shown are invariably of high quality in every respect while the extracts are consistently of very low grade and have no place in a superior lubricant. In several cases two different nitrobenzene treatments are shown further illustrating the flexibility of the process in that the quality produced can be varied to meet current market demand without changing crude source. The properties of the final finished oils show the quality of products obtained after dewaxing and clay finishing.

Reduced to its elements the nitrobenzene process consists of three steps; mixing the charge with nitrobenzene at a previously chosen temperature, allowing the mixture to separate by gravity into two layers, and removing the nitrobenzene from each layer by distillation. This is known as single stage operation and it is entirely feasible to operate a plant in this fashion. However, in order to obtain the maximum efficiency and economy of operation, some further refinements in the mechanics of this procedure are desirable. Before discussing these factors a consideration of the solvent itself is important.

Many materials are known which possess, in some degree, the ability to separate crude fractions into two parts. Hundreds of these have been used in the laboratory during the past eight years and the results obtained carefully analyzed. The result of this study has been the choice of nitrobenzene as the best material for this purpose. This choice is based on its excellence with respect to the 11 factors discussed below.

1. While no solvent is consumed in the operation there are, nevertheless, some small losses encountered and hence the cost of the solvent is an important item. Nitrobenzene can be purchased at about the lowest price of any effective material.
2. Another factor to be considered is the availability of the solvent. Nitrobenzene has been manufactured for years by a number of chemical concerns and is readily available in large quantities.
3. The specific gravity of the solvent is responsible, at least in part, for the separation of the two layers. Nitrobenzene has a high specific gravity (1.2) and hence gives complete separation in a very short time.
4. To be a satisfactory solvent a material should be chemically stable under the conditions of operation imposed. Nitrobenzene is stable under the operating conditions of the process. This has been carefully checked in the laboratory and is borne out in actual plant operation.
5. If a solvent which is not corrosive to steel and other common metals can be used, many operating difficulties can be avoided and the first cost of a plant reduced to a minimum. Nitrobenzene is such a material and the plant construction has been steel throughout except where water conditions required Admiralty metal.
6. Another vital point in considering the use of a material as a refining agent is its possible physiological effect on the workmen. Eight years of experience with nitrobenzene in the laboratory,





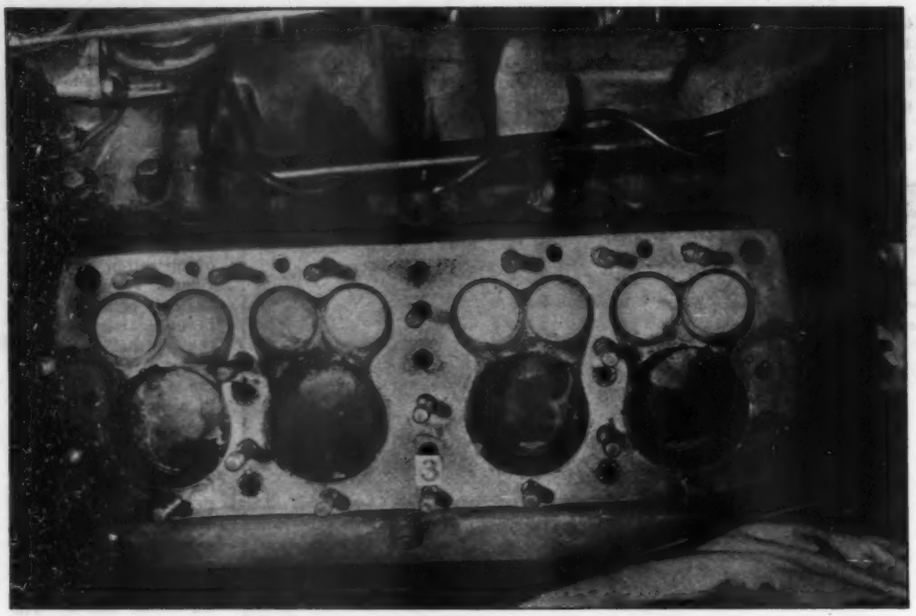


Fig. 3—Typical cylinder block after 100,000-mile test run

semiplant and plant have confirmed the experience of the chemical manufacturers of this material, namely, that while it has a toxic effect it can easily be handled, in a safe manner without hazard to employes, by using the simple precautions of cleanliness and the usual care of health.

7. The low volatility of nitrobenzene (vapor pressure .5 mm. at 90° F.) is responsible for low solvent loss due to evaporation, the absence of hazard due to vapor concentration, and the ability to operate the entire plant at atmospheric or subatmospheric pressures.

8. A good solvent for the separation of superior lubricants should possess selectivity. This can be represented by the difference in properties between the raffinate and extract. Some solvents have this property to a high degree as long as the concentration of oil in the extract phase is low, but lose it rapidly as this concentration is raised. Nitrobenzene has a high selectivity even when the concentration of oil in the extract phase is high.

9. If the selective solvent removes color in the extract phase the final decolorization of the lubricant is made easier. Nitrobenzene removes color bodies to a greater extent than any single commercially available solvent we have investigated.

10. The cost of solvent refining is largely the cost of distilling the solvent off the two layers formed in the process. The larger the volume of solvent to be distilled the greater the cost and hence it is highly desirable to use a solvent which has high solvent power and thus requires only a small volume to do the job. The solvent ratios employed in the nitrobenzene process are extremely low (.5 to 2 volumes per volume of charge oil).

11. The ability of a solvent to give satisfactory operation on any charge stock is of vital importance. Nitrobenzene is the only single solvent developed to commercial use which can effectively handle any stock from light distillates to heavy residuums.

Having selected the solvent we turn again to the details of the process. As stated above the single-stage operation leaves something to be desired when efficiency and economy are considered. This led to the application of the old principles of countercurrent contacting. This merely consists of a series of mixers and settlers through which the nitrobenzene flows countercurrent to a stream of charge oil. The number of settlers used is referred to as the number of stages. In this method the final raffinate leaves the system after being washed with fresh nitrobenzene and hence is entirely free from contamination with the undesirable constituents of the original charge oil. By using this countercurrent treatment it is possible to obtain the desired washing with a minimum volume of solvent and a maximum yield of raffinate of the desired quality.

There are three possible variables in this type of operation, namely, temperature, ratio of solvent of oil and the number of stages in the system.

Considering first the temperature of operation, the nitrobenzene process operates at or slightly below atmospheric temperature (40-80° F.). In general the higher the temperature used the more soluble the various components are in nitrobenzene, and hence the lower the volume of solvent required to accomplish a given amount of washing. However, the difference in solubility between the desirable and undesirable components is greater at the lower temperatures and hence the selectivity is greater under these conditions. The choice of the proper temperature then involves an economic balance between the cost which varies with solvent ratio and the yield which varies with temperaturre.

The second variable, the solvent ratio, is determined (temperature and the number of stages remaining constant) by the amount of material to be washed out which is in turn a function of the amount of improvement desired. Reference to Figure 5 will show that Pennsylvania type stocks require .25 to 1 volume of solvent per volume of stock while Mid-Continent type oils require 1 to 2 volumes and coastal oils from 1.5 to 2 volumes, when producing a really superior lubricant. The use of less solvent will result in a higher yield of a less highly refined oil.

The third variable, the number of stages employed in the countercurrent system, is again a question of economic balance. Other things being equal the greater the number of stages the lower the solvent ratio required for a given separation. However, as in a fractionating column, each additional stage does not produce the same effect and hence going beyond a given number is relatively useless. Laboratory data indicate that, in most cases, little advantage is gained beyond three theoretical stages. However, this is not a hard and fast rule. It is well to note here that the number of actual stages required is a function of how near an actual stage approaches a theoretical one, that is, one with perfect contacting in the mixer and perfect separation in the settler. This matter was thoroughly studied in semiplant scale equipment. As a result of this study the plant was installed with five actual stages and has produced practically equilibrium conditions. The mixing has in no case produced emulsions and the plant settlers have delivered the two products in yield proportions continuously and free from contamination.

With these three variables it is then possible to obtain a range of results to suit any individual requirement. Considerable work has been done on other modifications of the process and such work is in progress to improve the operation still further.

Recovery of Solvent

The recovery of solvent is accomplished in two steps, evaporation under vacuum using closed steam as the heating medium and finally stripping with open steam in a conventional plate column to remove the last traces of nitrobenzene. Simple analytical methods for process control have been developed and the products leave the system free of nitrobenzene.

By reference to the flow diagram Figure 6 the operations may be followed. Starting with the charge oil in tank M a pump is applied at any convenient pumping temperature and the oil delivered at a controlled rate through a water cooler. It is then mixed with the second stage extract and further cooled to operating temperature. This mix is then delivered to the first stage settler. Simultaneously nitrobenzene is withdrawn at a controlled rate from tank K, through an exchanger against the outgoing extract solution, through a chiller and thence to the fifth stage of the extractor. In the extractor the raffinate solution flows from No. 1 to No. 5 countercurrent to the extract solution flowing from No. 5 to No. 1. The raffinate solution leaves the extractor at No. 5 after being washed with pure nitrobenzene and the extract solution leaves No. 1. These solutions are then delivered separately through two similar systems of exchangers to the evaporators D and B. Here the solution flows in a shallow layer over submerged closed steam coils. The solvent is evaporated off and passes directly to the condensers and thence through a heat exchanger back to the solvent tank K ready for reuse. The oil leaving the last evaporators contains about 1 per cent of solvent. This is pumped through a steam heater to the top of the stripper towers E and C where it flows countercurrent to a stream of steam which removes the last of the solvent. The oil leaving the bottom of the strippers is pumped through exchangers to storage. The condensed overhead from the strippers, condensed steam from the vacuum pumps and any other water which enters the system flows to the separator tank F. Here the heavy nitrobenzene sinks and flows from this tank to storage for reuse. The small amount of water soluble in the nitrobenzene (.2 per cent) does not adversely affect the operation. The top layer of water containing .2 per cent nitrobenzene is delivered to the recovery evaporator G where about 15 per cent is vaporized

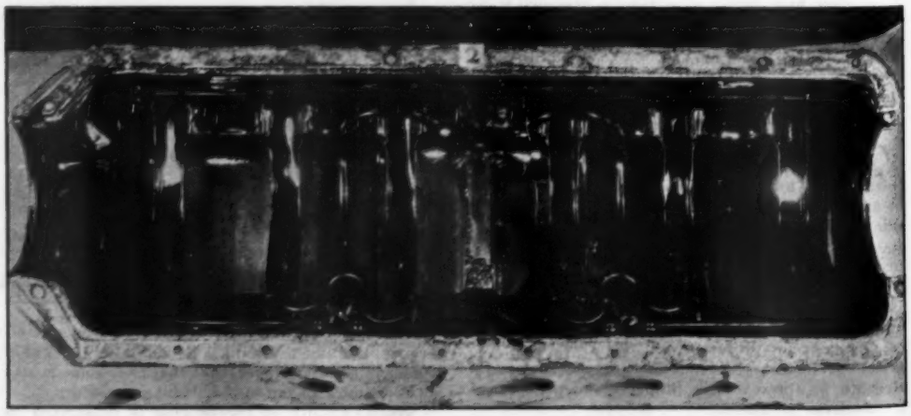


Fig. 4—Typical crankcase after 100,000 miles of engine operation

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carrying over the nitrobenzene with it. This overhead is returned to the separator F for separation while the remaining 85 per cent of the water, free from nitrobenzene, is discarded to the sewer.

The photograph (Figure 7) shows the settlers mounted on the roof of the control room; with the evaporators, strippers and heat exchangers on the gallery to the left.

The cost of steam, water, power and labor will vary in different refineries with a corresponding effect on the cost of solvent extraction. Accordingly, the consumption of these utilities for each barrel of charge oil is given in the Table Figure 8. It will be noted that the utility requirements increase as the solvent ratio increases. These requirements will not very appreciably with plant size and may be considered to apply to any reasonable sized plant, i.e., from 500 bbls. per day charge oil capacity upward. Operators are occupied principally in controlling the process. Since these duties do not change with capacity, operating labor is the same regardless of plant size. Two attendants are ample for control and hence the operating labor requirement is 48 man hours per day. The process is characterized by low temperature, low pressure operations employing noncorrosive materials. Repair and maintenance expenditures per year will not exceed about 3 per cent of the plant cost. Solvent loss has amounted to 0.1 per cent of the solvent circulated during the first year of actual plant operation. Losses incident to starting up a plant for the first time and training personnel are included in this figure. The low solvent ratio makes the actual loss very small. The extract oil is the only by-product of the extraction. This material is a good cracking stock or may be used as fuel depending on the demand for one or the other existing in an individual refinery.

The effect which increasing the solvent oil ratio may have upon utility consumption is apparent from the tabulations given in connection with nitrobenzene process operating costs. This same consideration may be used as a basis for comparing nitrobenzene with other solvents. Nitrobenzene and three other solvents, all of which are employed commercially were used in a standardized laboratory extraction system to prepare raffinates from three different charge stocks. Each solvent was used at its optimum extraction temperature as indicated by preliminary tests. The solvent ratio was adjusted in an effort to prepare raffinates of equal quality. The tabulated results (Figure 9) show that when any of these solvents are used at the proper temperature on distillate stocks similar results as to yield and V.G.C. may be expected. For the residuum solvent A and C are obviously unsuited. If more of solvent B had been used on the residuum the V.G.C. and yield obtained with nitrobenzene could probably have been duplicated. However, only nitrobenzene gave sufficiently short settling times to permit plant operation on this residuum. Before leaving the question of quality, however, it should be noted that nitrobenzene produced the best Conradson carbon and color reduction. Filter yields are highest when nitrobenzene is used and hence, lower finishing costs can be anticipated for these raffinates. For use with this tabulation a circulation of the utility costs incident to operation with different solvents was made. The results of these calculations are presented graphically by the chart, (Figure 10) on which an additive cost scale is used. The bases of the calculations are all given. No heat exchange was included in the calculations since such economies are equally available to all processes.

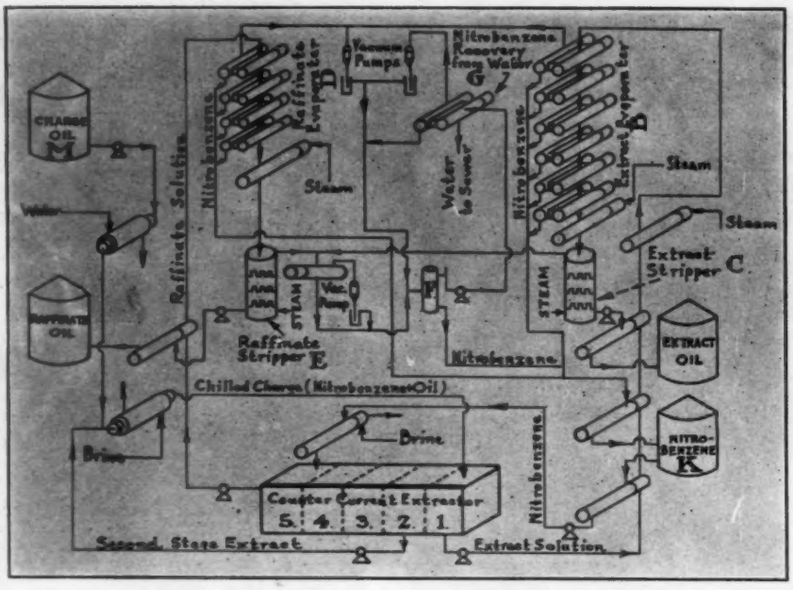

Fig. 6—Flow chart of nitrobenzene extraction process

If a solvent-oil ratio of two to one is used for each solvent, Solvent A will be cheapest followed by nitrobenzene, Solvent B, and Solvent C in order. It is interesting to note that at the same solvent-oil ratio the cost of any of the other solvents is within approximately 10 per cent of the cost for nitrobenzene. However, operating costs at the same solvent ratio should not be compared. Rather, the cost of preparing a given quality of product should be the basis of comparison. Thus, for the light distillate the following tabulation results by using the solvent-oil ratios for each solvent from the table. (Figure 9), and the corresponding cost from the chart, (Figure 10).

Solvent used—	Solvent:oil ratio	Cost
Nitrobenzene	1.60	4.3
Solvent A	3.25	6.7
Solvent B	2.25	5.8
Solvent C	3.50	9.1

A similar tabulation for the heavy distillate is shown below:

Solvent used—	Solvent:oil ratio	Cost
Nitrobenzene	2.00	5.1
Solvent A	5.00	9.7
Solvent B	3.50	8.6
Solvent C	5.00	12.50

The results obtained on the residual stock are not directly comparable since the raffinates produced are not of the same quality. In addition to this Solvents A, B and C are obviously not suited for operation on this stock.

While it is true that the costs of solvent refining can be reduced by the use of heat exchange or

FIG. 5—NITROBENZINE TREATMENT OF VARIOUS STOCKS

Remarks:	Run number	Per cent solvent based on stock	Temp. °F.	No. of stages	Raffinate Inspections: Measured yield	Yield calculated from grav.	A.P.I. gravity	Vis. at 210°F.	Vis. at 120°F.	Vis. at 100°F.	V.G.C.	Vis. index	O.D. color*	Con. carbon	Pour °F.	Flash °F.	Fire °F.	P.M. flash	Extract Inspections: Measured yield	Yield calculated from grav.	A.P.I. gravity	Vis. at 210°F.	Vis. at 100°F.	V.G.C.	Vis. index	O.D. color
PENNSYLVANIA TYPE OILS																										
Neutral					Stock		30.0	44.4	93.8	174	0.822	92	53	0.04	0	425	500	420								
	89	25	41	3	94.7	97.2	36.4	44.3	89.8	168	0.820	95	45	0.01	5				4.0	2.8	17.3	54	209	0.905	15	.....
	92	40	41	3	87.0	87.1	31.6	43.9	86.3	157	0.813	100	44	0.03	0				11.5	12.9	19.6	50	380	0.892	24	.....
Steam re-					Stock		26.2	143	825	...	0.815	98	2,929	2.14	30	555	640	505								
fined	115	70	41	3	94.0	92.7	27.5	127	655	...	0.803	105	1,690	1.4	65				6.3	7.3	11.5	712	...	0.910	...	.....
	84	100	41	3	89.5	87.2	28.2	129	610	...	0.800	106	1,372	1.05	40				10.5	12.8	14.8	341	...	0.890	...	.....
Long					Stock		28.3	80	...	740	0.810	105	1,488	1.2	75	465	525	455								
resid-	121	50	41	3	94.2	93.6	29.2	76	...	659	0.806	109	1,198	0.9	90				4.4	6.4	16.2	120	...	0.894	...	8,913
uum	125	100	41	3	86.6	86.4	30.2	74	...	575	0.800	111	992	0.6	95				13.8	13.6	17.2	111	...	0.888	...	.....
MID-CONTINENT TYPE OILS																										
Neutral					Stock		23.3	50	122	267	0.864	59	320	0.06	35	410	470	385								
	Plant	140	41	5	42.1	41.4	32.0	47	88	161	0.810	108	20	0.05	45	410	475	415	57.9	58.6	17.7	57	510	.902	−3	822
		Finished oil.					31.0	45	96	180	0.816	98	....	0.01	15	420	480	410								
Long					Stock		24.2	87	427	...	0.836	85	6,670	2.9	70	425	490	305								
resid-	142	100	50	3	70.5	71.8	28.6	79	332	...	0.806	99	3,100	1.0	100				27.0	28.2	14.0	158	...	0.908	...	.....
uum	143	150	50	3	63.5	65.7	29.4	76	296	...	0.800	106	2,544	0.7	100				35.5	34.3	15.1	139	...	0.902	...	.....
Short					Stock		22.1	159	1,094	...	0.841	90	9,940	3.9	95	515	595	...								
resid-	160	100	41	3	74.1	72.9	26.8	110	558	...	0.812	99	3,927	1.7	...				25.5	26.1	10.2	711	...	0.923	...	23,800
uum	162	200	41	3	63.0	63.1	28.2	102	503	...	0.802	105	3,618	1.56	100				37.0	36.9	12.7	402	...	0.906	...	24,276
COASTAL TYPE OILS																										
Light					Stock		21.7	61	260	667	0.844	38	267	0.13	55	420	505	430								
distil-	Plant	150	41	5	51.0	51.2	25.8	53	162	339	0.820	87	6	0.01	55	445	510	435	49.0	48.8	14.9	79	2,063	0.914	−50	746
late		Finished oil.					28.5	53	157	344	0.820	90	...	0.01	0	440	500	385								
Heavy					Stock		26.4	118	863	2,725	0.860	47	1,482	0.88	25	510	595	435								
distil-	Plant	200	60–115	5	46.2	45.3	28.2	81	365	1,248	0.808	91	88	0.03	65	510	595	485	59.8	54.7	14.5	202	...	0.900	...	3,025
late		Finished oil.					27.4	82	394	915	0.813	90	20	0.01	0	510	580	470								
Resid-					Stock		16.8	443	...	...	0.868	...	28,605	6.9	75	555	635	520								
uum	Plant	200	60–115	5	46.2	39.8	26.3	170	...	...	0.808	...	10,482	1.8	120	575	660	535	59.8	60.2	11.7	1,186	...	0.902	...	42,414
		Finished oil.					25.3	150	987	2,758	0.817	90	118	0.34	15	535	620	490								
Heavy					Stock		14.4	393	...	...	0.880	...	58,000	...	65	590	675	390								
resid.	59	200	50–112	2	36.2	39.6	25.0	210	...	...	0.814	...	9,509	...	50				63.2	60.4	8.2	4,100	...	0.918	...	90,600

*O.D. Color—The optical density color scale is an additive scale on which 500 = 8 A.S.T.M. (approximate). An oil having an O.D. color of 1,000 has twice the concentration of color bodies as an oil of 500 color.

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in other ways, it should be remembered that these economies are equally available to every process and the cost relations will remain the same if consistent bases are used for the calculations. Thus, the solvent extraction process which requires the lowest solvent:oil ratio has a very real economic advantage.

Installation Costs

The cost of plant construction will also vary with the solvent:oil ratio required for treating since larger equipment will be needed to handle the extra solvent. For the nitrobenzene process the variation of plant cost with solvent ratio and capacity is shown by the table, Figure 11. These costs are consistent with each other and with the utility requirements which have been given. Variations in standards of construction and the location of the plant will obviously affect these figures and hence they should be considered only an approximation. The cost of installing such refrigerating equipment as is required by the process is included.

Finished Lubricants

The nitrobenzene process may be applied either before or after the dewaxing process on most stocks. A few very waxy stocks where the paraffinic oil content is low result in raffinates with wax contents of the order of 50 per cent. In these cases some dewaxing before solvent extraction is desirable, since this aids in the operation of the solvent extraction process and also produces a raffinate which can be efficiently dewaxed. In general, the problem of when to dewax is answered by considering the economics involved. If dewaxing is accomplished before solvent extraction the throughput of the dewaxing process is higher than if solvent extraction precedes dewaxing. On the other hand, when solvent extraction preceded dewaxing the oil left in the wax cake is the highly paraffinic valuable material and represents a larger dollar loss than in the previous case. Solvent extraction has no deleterious effect on the dewaxing process and any method which can be used on the stock will be equally effective on the raffinate.

The only additional step, other than dewaxing, is a decolorization process. Clay finishing is all that is required and in many cases the raffinate color is so light that clay treatment consists in little more than a straining operation.

Contacting or percolation are equally effective. The clay consumption is always much lower than

FIGURE 8—UTILITIES REQUIRED FOR TREATING ONE BARREL (42 GALLONS) OF CHARGE OIL WITH NITROBENZENE

Volumes of solvent used for treating one vol. of charge oil	Steam* saturated at 150 lbs. gal. (lbs.)	Water†, temperature rise 30°F. (gals.)	Power‡ (kilowatt hours)
0.5	124	370	2.05
1.0	184	940	2.30
1.5	244	1,010	3.55
2.0	304	1,080	4.30
2.5	364	1,150	5.05

*Steam is used for heating, solvent evaporation, and part of the pumping. The resulting exhaust steam is utilized in stripping and in recovering dissolved solvent from waste water. Heat exchange is employed where economical. Heat requirements are calculated using latent and specific heats. For a conservative estimate, based on plant operating data, the steam consumption may be increased by 20 per cent to provide for radiation, line loss and contingencies.

†Water is used for the removal of heat above 90° F. and in the production of refrigeration. Specific and latent heats are used to calculate the requirement.

‡Power is used for mixing, pumping and in the production of refrigeration. Although the consumption of power indicated is closely checked by plant operating data 15 per cent may be added for a conservative estimate.

FIGURE 11—APPROXIMATE CONSTRUCTION COSTS IN DOLLARS FOR NITROBENZENE EXTRACTION PLANTS

Plant charge oil capacity, bbls. per day	Volumes of nitrobenzene required to treat one volume of charge oil. 0.5	1.0	1.5	2.0	2.5
1,000	175,000	200,000	250,000	275,000	325,000
1,500	225,000	275,000	325,000	400,000	450,000
2,000	275,000	350,000	425,000	500,000	575,000
2,500	325,000	425,000	525,000	625,000	700,000
3,000	375,000	500,000	600,000	725,000	825,000

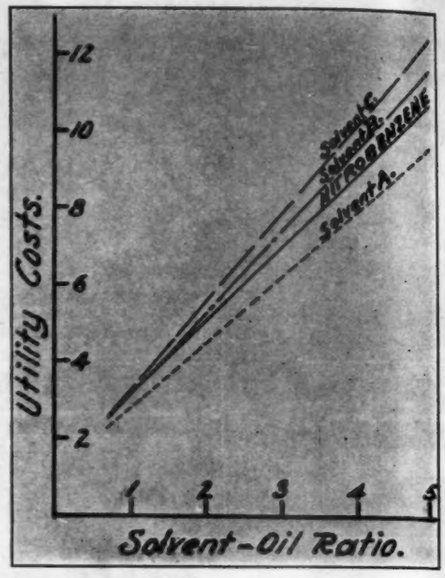


Fig. 10—Comparison of the cost of steam water, power and solvent loss for various solvent processes over a range of solvent ratios.

FIG. 9—COMPARISON OF SOLVENT REQUIREMENTS

Nitrobenzene and Three Other Commercial Solvents

Solvent—	Volumes of solvent used per vol. of charge oil	Volumes of solvent A. B or C per vol. nitrobenzene	Raffinate properties: Yield per cent by volume	V.G.C.	Conradson carbon	O.D. color	Filter yield in barrels/ton of clay or O.D. color after identical clay contacting
Distillate stock 22.0° A.P.I. 59.5 S.S.U. Vis./210° F.				0.863	0.04	318	Finished to 1 A.S.T.M. color
Nitrobenzene	1.60	...	48.1	0.816	0.01	20	70 Bbls./ton
Solvent A	2.25	2.03	49.0	0.815	0.01	45	50 Bbls./ton
Solvent B	2.25	1.41	46.5	0.817	0.02	19	60 Bbls./ton
Solvent C	3.50	2.19	47.4	0.816	0.04	27	70 Bbls./ton
Distillate stock 20.4° A.P.I. 110 S.S.U. Vis./210° F.				0.861	0.76	1,410	Finished to 4½ A.S.T.M. color
Nitrobenzene	2.00	...	54.2	0.813	0.10	131	53 Bbls./ton
Solvent A	5.00	2.50	54.8	0.812	0.15	691	6 Bbls./ton
Solvent B	3.50	1.75	46.1	0.814	0.08	293	47 Bbls./ton
Solvent C	5.00	2.50	49.2	0.813	0.70	595	14 Bbls./ton
Residual stock 17.1° A.P.I. 444 S.S.U. Vis./210° F.				0.865	6.4	30,250	O.D. color after clay contacting
Nitrobenzene	2.00	...	44.5	0.818	1.8	9,740	194
Solvent A	4.50	2.25	21.4	0.826	4.6	38,400	19,280
Solvent B	2.50	1.25	48.6	0.826	3.0	16,600	2,130
Solvent C	5.00	2.50	63.5	0.834	4.4	34,200	15,200

Basis

Five-stage countercurrent extractor. Heat supplied by Sat. 105-lb. ga. steam water removes heat above 90° F. Refrigeration removes heat below 90°. No heat exchangers are used. Extraction temperatures for best solvent efficiency used in each case. Solvent from and to each cycle at 90° F. Oils from tankage at 120° F. Oils to tankage at 150° F. Specific and latent heats of materials taken from the literature. To produce 1 ton of refrigeration 30 k.w.h. and 6,050 gallons of water are used. Solvent loss 0.1 per cent per use. Labor and repairs not included.

Utility Prices

Steam at $0.36 per 1,000 pounds. Water at $6 per 1,000,000 gallons. Power at $0.01 per kilowatt hour. Solvent at current market price

As the use of propane and butane in solvent refining and polymerization becomes more general the number of pressure tankage farms like the one shown here will greatly increase and the scene such as that above, will be made a part of the skyline in most refining areas

that required on the original stock, but, of course, varies greatly with the type of original stock, the viscosity of the material, and whether it was produced from a distillate or a residuum.

Conclusions

The refiner of today is faced with the problem of making lubricants having high chemical stability, high viscosity index and low carbon residue at a low cost, without resort to special crudes, and without changing the whole refinery to obtain some special cut from the crude.

The nitrobenzene process offers a solution to this problem because when this process is used, lubricants having a high chemical stability, high viscosity index, and low Conradson carbon value can be made. This can be done at a low cost because there is no degradation of oil to sludge; an economically maximum yield of superior lubricating oil can be obtained; the low solvent ratio required insures a minimum consumption of utilities for its recovery; the low temperature, low pressure, automatically controlled plant insures continuous operation with a minimum of attention and repairs as well as minimum first cost; and the large removal of color in the extract layer insures a minimum of cost for the final clay treatment. In addition to this, the process can be used effectively on a wide range of charge stocks from extremely paraffinic to naphthenic and from light distillates to heavy residuum, thus making the refiner independent of special crude sources.

New Bureau of Mines Bulletin Discusses Wax Manufacture

The economic importance of paraffin wax has warranted publication by the Bureau of Mines, Department of the Interior, of a detailed treatment of the manufacturing processes and equipment used in the production of paraffin wax from petroleum. Wax is a necessary by-product in the manufacture of most lubricating oils and is a valuable product of the refining of many crude petroleums.

Continuing and extending the work on petroleum waxes begun by L. D. Wyant and L. G. Marsh some years ago, Ralph H. Espach, petroleum engineer of the Bureau of Mines, gathered data from wax manufacturing refineries in various parts of the country whose output of wax at the time the study was made represented more than 75 per cent of the nation's paraffin wax production. The results of this study are reported in a bulletin of 113 pages which gives an overall picture, with many special features, of wax manufacturing as now practiced in the United States. Many of the 37 illustrations of the report show equipment for processing wax distillate and manufacturing paraffin wax.

Removal of wax from luricating oil fractions is a rather expensive refining operation. The equipment necessary for wax removal is costly, but it has long life and its maintenance costs are low. The equipment for finishing crude wax into commercial products is not costly compared with that for removing the wax from the oil. As the cost of wax removal is chargeable to the lubricating oil, the actual refining of the crude wax into commercial products should be profitable even with the low prices for wax that have obtained for several years.

The quantity of wax exported from the United States in 1931 and all previous years for which there are records, exceeded the domestic demand. Since 1931 the quantity of exported wax has been less than the domestic demand for wax, and in 1933 was about 70 per cent of the domestic demand. The imports have not been more than 8 per cent of the United States production. Virtually all of the imported waxes come from the Netherland East Indies and British India and are of the higher-melting-point grades.

Paraffin wax has many and varied uses because it has convenient melting points, will bend and is tenacious at ordinary temperatures, does not deteriorate, is impervious to water at atmospheric temperatures, and has a high dielectric strength. It is used extensively in the manufacture of candles; the impregnation of waxed papers; the coating of paper cartons (butter, cheese, ice cream), drinking cups, milk bottles, and milk-bottle tops; electrical insulation; waterproofing; the impregnation of match tips; floor and furniture polishes; laundering; the protection of preserves and jams from fermentation; coatings for cheeses to improve their appearance and to prevent mold, evaporation, and shrinkage; the lining of butter tubs; coatings for beer vats and barrels (vinegar, cider, alcohol, whisky, molasses, and sauerkraut); coatings for meats, sausages, and other products which must be prevented from drying; protective wax dressings for burns; the manufacture of artificial flowers; etching glass; miners' lamps and marine bunker lights; waxing yarns in the textile industry; stuffing or loading for leather in tanneries; and for numerous other materials and purposes.

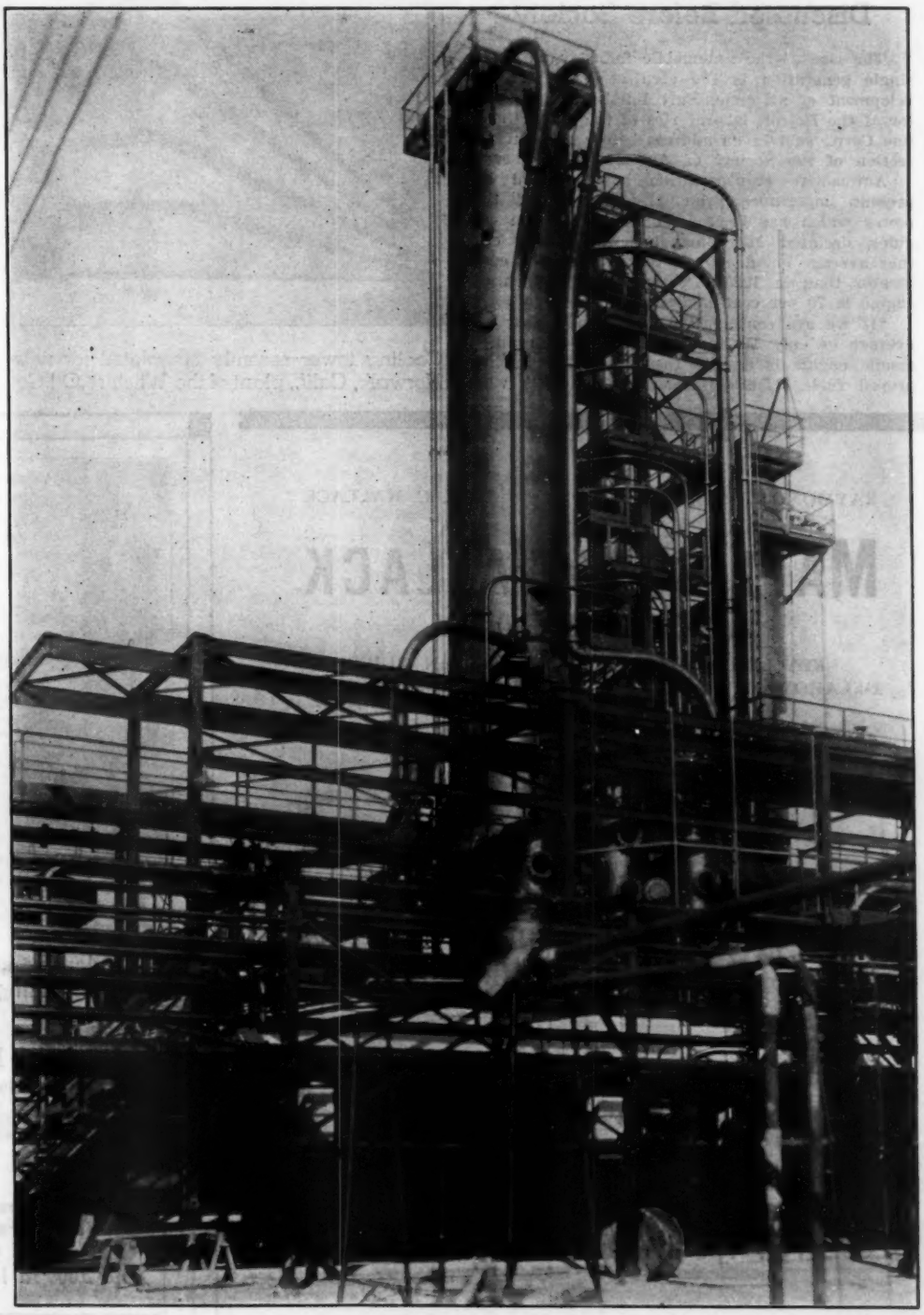
To establish a suitable foundation for the descriptions of manufacturing equipment and processes, a section of the Bureau of Mines report deals with the properties of paraffin wax such as melting point, color and appearance, tensile strength, oil and moisture content, and solubility. The batch, continuous, vacuum, and coke or rerun methods of processing wax distillates are discussed. Various types of wax-chilling equipment and the methods and equipment for filter-pressing chilled wax distillate are given detailed treatment. The bulletin deals also with slack wax, sweating, and the products of sweating, such as foots oil, intermediate wax, scale wax and refined wax.

The paper also discusses methods of handling finished wax, and the text and illustrations describe molding wax into large and small cakes, barrelling, and molding into candles. Wax-plant arrangements and personnel requirements for various sizes of plants are discussed briefly.

Copies of Bureau of Mines Bulletin 388, "Manufacture of Paraffin Wax from Petroleum" by Ralph H. Espach, are for sale by the Superintendent of Documents, Washington, D. C., price 15 cents.

Automotive Money-Saving Facts

Many oil companies now use large fleets of automobiles and trucks and should be interested in economy of operation and efficiency. Believing this condition warranted discussion J. F. Winchester, manager, General Automotive Department, Standard Oil Co. of New Jersey, New York City, has written a book entitled "Automotive Money-Saving Facts" which contains a practical review



Atmospheric tower on one of the combination units at the Gulf plant in Port Arthur, Tex.

of many specialized fields within the transportation industry and gives direct facts based upon world-wide supervision and observations of design and operating practices.

The author has contributed to technical magazines and the public press for a number of years and is also associated with several associations and societies active in handling transportation problems.

The facts presented have been selected with the idea they will help those who follow them to better meet problems developed through rulings of Interstate Commerce Commission, state laws and higher commodity prices.

The book contains more than 400 pages and is well illustrated. It is divided into 37 chapters and each chapter deals with some particular phase of this general subject, so the reader will secure a very complete picture if the whole book is read and studied.

The book is handled by the book department of The Oil and Gas Journal and sells for $3.00 per copy.

Progress of Automotive Engine Discussed Before Society

The rise of the automobile industry within a single generation is the greatest industrial development of all time, Earl Bartholomew, director of the Detroit laboratories of the Ethyl Gasoline Corp., said in an address before the Buffalo section of the Society of Automotive Engineers.

Automotive transportation has achieved its present importance principally because of the power which has been made available from engines, declared Mr. Bartholomew, pointing out that average engine power today is 85 per cent greater than in 1925. Power per cubic inch of engine is 70 per cent higher.

"If we are conservative and assume that an average of only 12 horsepower from each automobile engine is due to the availability of improved fuels, 3,500,000 American motorists who are buying cars this year have 42,000,000 additional horsepower at their command," Mr. Bartholomew explained.

"It is apparent that improvements in the antiknock value of fuels supplied by oil refiners, coupled with correlated engine design for taking advantage of it, has been a boon to the motoring public.

"Boulder Dam is an outstanding engineering achievement but its 1,800,000 horsepower generating capacity is relatively a small figure. In fact, the installed water power generating capacity of the whole world is only 45,500,000 horsepower. The factories of the United States with products valued at $5,000 or over per year have 43,000,000 horsepower of driving machinery.

"The steam generating capacity in all of the public utility plants in the United States is approximately 35,500,000 horsepower and the number of customers about 25,000,000. The average generating capacity per customer is therefore 1.42 horsepower. Two to four horsepower were formerly enough to take care of the transportation of a family but now an average of 90 are required and almost everyone would like to have more."

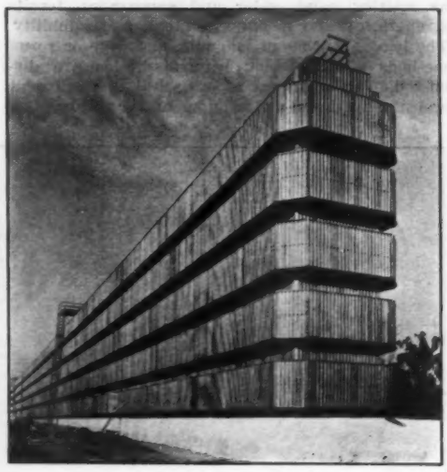
Opportunity for further improvement of automobile engines is even greater than past progress would indicate, Mr. Bartholomew asserted. Four ways are available for increasing brake mean effective pressure, now about 100 pounds per square inch, which would result in the development of the same or more power by a smaller engine, he continued. These are:

Drastic changes in the design of engines for the purpose of securing better cooling; an increase in compression ratio and the use of fuels of higher antiknock value; supercharging; a combination of two or more of the above design features.

"At a fuel consumption of 1.5 pounds per brake horsepower per hour, which is about an average for conditions of slow speed driving, an engine converts less than 10 per cent of the calorific value of the fuel into power," Mr. Bartholomew said. "At wide-open throttle with the mixture for best economy, a condition rarely approached in service, the thermal efficiency is only about 25 per cent.

"A considerable opportunity remains for the better utilization of fuels now available. At present the octane requirement of an engine is determined by the knocking tendency at the speed where detonation is most pronounced. At other speeds there is an excess of antiknock value.

"It is not convenient to provide an automatically variable compression ratio to produce constant knocking tendency at all speeds but it appears feasible to provide for volumetric efficiency kept at the maximum for each speed consistent with the antiknock value of the available fuel. Some progress has already been made along this line by the use of higher compression ratios and the vacuum controlled distributors, the latter re-



Cooling tower recently completed for new Norwalk, Calif., plant of the Wilshire Oil Co.

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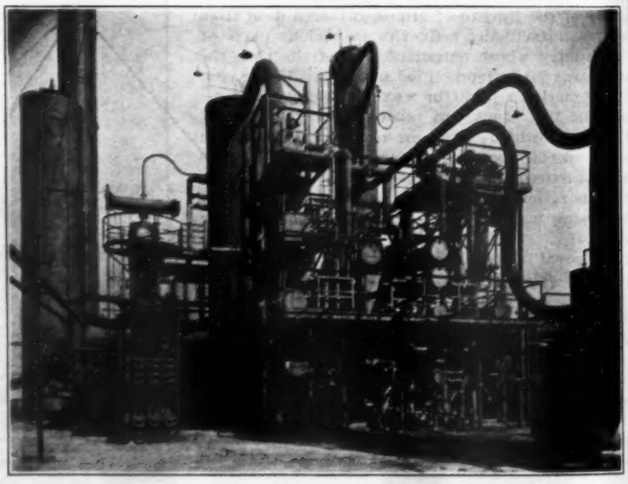

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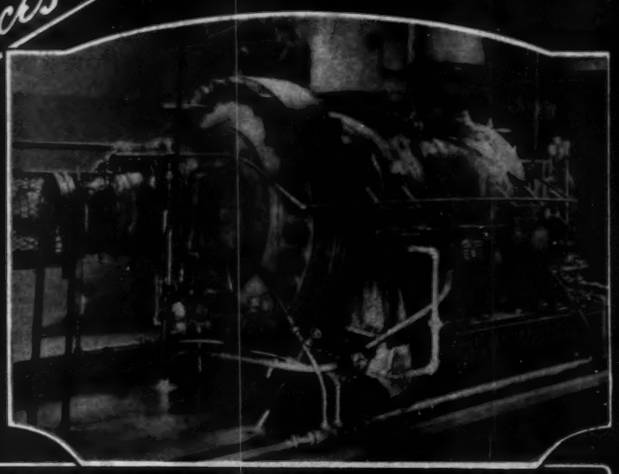

HOT OIL CHARGING PUMP

THIS PICTURE tells a dramatic story of engineering achievement. The photograph was taken in the cracking unit of the Atlantic Refining Company at Point Breeze, Pa. It shows a new type of dual driven high pressure Byron Jackson Hot Oil Charging Pump actually photographed while delivering 1350 GPM hot oil at a pumping temperature of approximately 700 degrees F. and having a discharge pressure of 1100 pounds gauge.

In this installation considerable saving was effected in both first cost and power economy over a conventional dual drive unit. The turbine driver, connected through a jackshaft coupling at one end of pump, is much smaller in rated horsepower than the motor connected through a jackshaft coupling at opposite end. The motor normally drives the pump, the turbine serving only as a standby in the event of electric power failure.

One 1000 HP, 3 phase, 60 cycle, 2200 volt, 3600 RPM squirrel cage induction motor drives the pump in normal operation. For starting purposes, to bring the unit on stream or in the event of power failure, a 250 HP non-condensing steam turbine handles the necessary load. Both steam and electric drives are permanently connected to the pump; when the motor is pulling the load, the turbine is rotating at the same speed and when the turbine is pulling the load the motor is rotating at the turbine speed.

In the event of power failure, when the speed drops to 2500 RPM, the turbine governor automatically begins to function, admitting the full steam supply to the turbine, which then takes the necessary load at a constant speed of 2500 RPM. At this speed the pump discharges against a pressure of approximately 750 pounds gauge, which affords sufficient circulation of oil through the system to prevent coking of the tubes in the furnace. When the power supply is re-established the motor is started and the turbine automatically cuts out.

This installation is effective also for such emergencies as loss of tower pressure, in which event the motor can be cut out by pressing a button. A substantial reduction in cost of starting equipment for the motor is gained, as this type of unit is always started with the turbine and therefore an across-the-line type starter can be used instead of an expensive automatic reduced voltage compensator.

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tarding the ignition timing in the speed range of greater knocking tendency.

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It is certain that the future price of crude oil will influence both the price and chemical structure of gasoline, according to Mr. Bartholomew. Gasoline will change with automobiles, he held.

"Whatever the cost of tomorrow's crude oil, it will be the aim of the petroleum industry to provide the greatest amount of available power per dollar. By far the most important problem is that of providing at the lowest possible cost a gasoline of sufficiently high antiknock value for the satisfactory operation of engines which will use the fuel.

"Unfortunately, nature has in general combined the carbon and hydrogen in petroleum into compounds of fairly low antiknock value. The conversion of these compounds into others of decreased knocking tendency increases the cost of the finished product, the law of diminishing returns operating as the octane number goes up.

"Clear, simple liquid though it appears, a single drop of gasoline contains hundreds of different chemical compounds among its two hundred billion billion molecules. Consider that if the earth were divided into the same number of equal parts, each cube would be less than 6 feet on a side.

"It is apparent that years of patient research have been required in many laboratories to investigate the composition of gasoline made from many crudes by an almost equal number of processes, to synthesize the hydrocarbons and to determine their properties, including knocking tendency.

Dickey Refining Co. Completes Uni-Coil Injection Test Run

The first test run of the new "Uni-Coil Injection Process" for cracking, at the McPherson, Kan., refinery, of the Dickey Refining Co., was recently completed. Substantial improvements are reported to have been realized under the new arrangement, the test run having been made on their revamped combination unit. The equipment which originally employed a simple coil cracking cycle was remodeled by the Dickey organization to incorporate a number of features made available through a license acquired under patents of Gasoline Products Co., Inc.

The "Uni-Coil Injection Process" employs "clean circulation" with a "non-quenching" type of operation, effecting cracking and viscosity breaking in a single coil. It is found to be particularly advantageous on residual stocks requiring greater viscosity breaking, and yet permits entire flexibility in the high temperature cracking conditions with corresponding latitude in the antiknock value of naphtha and in the character of fuel oil production. Ultimate advantages in the yield and character of products inherent in the operation would indicate that the Dickey installation may be the forerunner of others by refiners of comparable size.

The combination of features employed by the "Uni-Coil Injection Process" was first introduced in the plants of certain of the major licensees of Gasoline Products Co., Inc., after extensive commercial proving on a large scale in recent years, the installation and application of the process to a plant of 2,400 bbls. per day crude capacity, by the Dickey Refining Co., indicates that it will permit the smaller refineries to realize numerous benefits usually obtainable with considerably more elaborate equipment. The more elaborate equipment is generally unadapted to the small or moderate scale operation.

The process which is being licensed by Gasoline Products Co., Inc., is understood to be fully covered by patents owned or controlled by them, including the Behimer Patent No. 1,883,850, and Black Patents Nos. 1,706,396, Reissue 18,896, 1,971,248 and 2,018,654.

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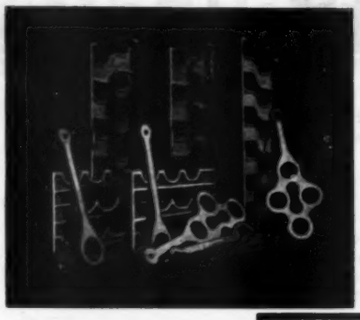

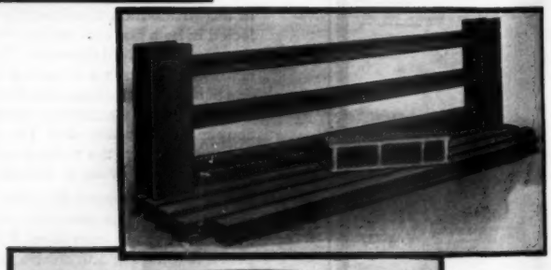

AMSCO Alloy is highly resistant to the elevated temperatures and corrosive gases to which still parts are subjected. Correctly applied, it does not crack, warp, bend or scale at temperatures up to 2100° F. Installation reports at hand are ample proof of these claims—one shows eight years of service in cracking stills in operation 97% of the time, at temperatures ranging from 1400° to 1600° F. without sign of fatigue or failure—a true testimonial to the unusual heat and corrosion resistant properties of AMSCO Alloy. Illustrated are a few typical still parts of AMSCO Alloy—tube supports, beams, hangers, and end plates. For your still parts, demand castings of AMSCO Alloy—they last longer! Typical or pilot castings are x-ray inspected for your protection. Write for detailed information.

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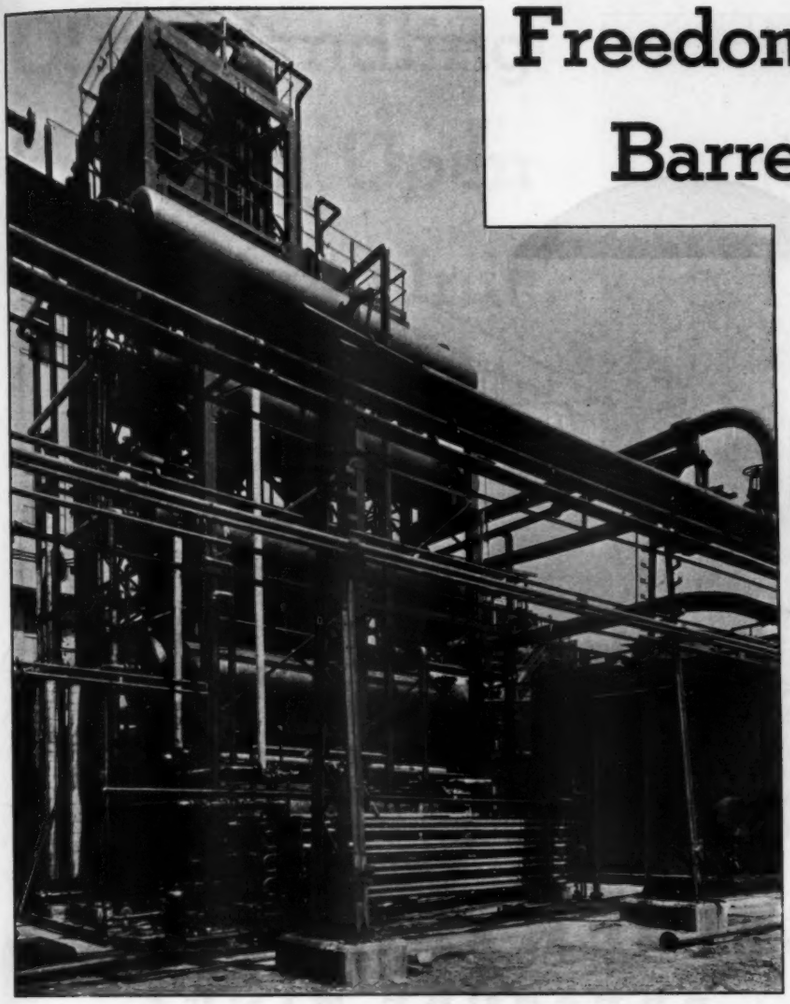
Freedom Charges 1,400 Barrels Daily to New Solvent Plant

By D. B. WILLIAMS
Carbide and Carbon Chemical Corp.



General view of new chlorex plant at the Freedom Oil Works. Here are shown preheaters, coolers and the extraction system in foreground. The distillation units for the recovery of the solvent and oil are in the rear

The seventh commercial chlorex plant was placed in operation on June 25, 1935, by the Freedom Oil Works Co., Freedom, Pa. This unit which was built by Leader Industries, Inc., has a rated capacity of 500 bbls. per day of Pennsylvania steam refined cylinder stock and 1,200 bbls. per day of neutral. The plant has operated almost continuously since it was first placed in operation. Daily charging rates of 600 bbls. per day of steam refined and 1,400 bbls. per day of neutral have been attained.

Detailed flow diagrams of the chlorex process have appeared in the literature. A brief description of the method of operation at Freedom follows: Oil and chlorex are pumped under automatic flow control through heat exchangers provided with connections for either steam or water depending on whether it is desired to heat or cool the charge to the desired extraction temperature. The oil and chlorex pass counter-currently through a system of four settlers and four mixers, the interface level in each settler being under automatic float control. Final extract and raffinate solutions from the countercurrent extraction system pass into their respective surge tanks. From the surge tanks each solution is fed to the distillation unit at a constant rate. The extract solution passes through a steam preheater and from there into a dry flash evaporator operating under a vacuum of 26 inches Hg. Removal of the solvent from the extract solution is completed in a vertical bubble cap stripping column maintained under a vacuum of 28-29 inches Hg. Chlorex is recovered from the raffinate solution in a single stripping column held at 28-29 inches Hg. vacuum. On the extract and raffinate stripping columns open steam is used to facilitate complete removal of the solvent. Condensed chlorex vapor and steam from the condensers pass through a settling tank where the water and solvent are separated. Chlorex is pumped from the bottom of the settler continuously, to storage for reuse. The water layer which contains approximately 1 per cent chlorex passes through a steam preheater and into a small column consisting of a length of 12-inch pipe packed with jackstones. The preheated chlorex bearing water enters at the top of the column. Exhaust steam enters the bottom of the stripper. The overhead vapor which is rich in chlorex is condensed and separated in the water-chlorex separation tank. Denuded water, 100 per cent free of chlorex, is pumped from the bottom of the column to the sewer. This water stripping unit operates continuously. Chlorex losses in the Freedom plant have been running from .04 to .08 per cent by volume of the total chlorex circulated since operation was started.

Typical plant results on steam refined cylinder stock are shown in Table 1. The stock was treated at 75-80° F. using a 1.5:1 chlorex-to-oil ratio by volume.

Extracts of 9.6° A.P.I. gravity and 1,300 viscosity at 210° F. have been made here. A very appreciable increase in filter yield was secured when making 8 color bright stock from the raffinate as compared with former yields when running 152 at 210° F. steam refined to the same bright stock specifications conventionally. Approximately 75 per cent of the oil treated in this plant since June, 1935, has been steam refined cylinder stock.

Excellent results have been secured when treating neutral oils. Plant results are shown in Table 2. The neutral was treated using a 0.5:1 chlorex-to-oil ratio at 70° F.

TABLE 1—TYPICAL PLANT RESULTS

Inspections—	Stock charged	Raffinate	Extract
Yield %	100	94.4	5.6
Gravity °API	27.2	28.1	13
Flash °F	575	575	..
Fire °F	635	635	..
Vis. 210° F. S.U. Sec.	164	155	625
Carbon res. per cent	2.10	1.38	

TABLE 2—YIELD DATA

Inspections—	Stock charged	Raffinate	Extract
Yield per cent	100	95.54	4.46
Gravity °API	31.9	32.8	15.4
Vis. 100° F.*	168.5	156 6	864
Vis. 210° F.*	43.9	43.4	60
V. I.	105	112	—20
Color N. P. A.	3½+	2+	..
Pour °F.	25	25	..

*Viscosities determined with Ostwald pipettes. Viscosity index determinations by Penn. State method.

General view of site upon which Pan American will erect at Texas City a 30,000-bbl. per day combination cracking unit and a 24,000,000-foot per day catalytic polymerization unit.

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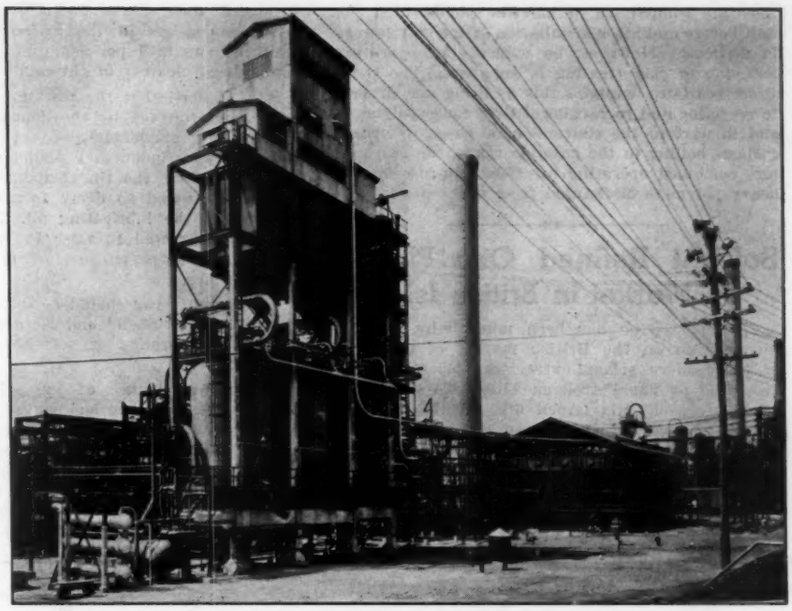
PLANTS AT DALLAS AND HOUSTON

Clay Handling Speeded Up in Atlantic's Unit



Clay handling equipment installed by the Atlantic Refining Co. at Philadelphia, Pa., as part of the company's new combination cracking unit

An unusual Gray treating and clay handling installation, recently added to the 20,000-bbl. combination cracking unit of the Atlantic Refining Co. at Philadelphia, is interesting from the equipment as well as the operating aspect.

The clay treating equipment was installed during 1935 in connection with the combination cracking unit after the latter had been operating for almost a year before the Gray plant was in use. Both cracking plant and Gray equipment were erected by the M. W. Kellogg Co., with the cooperation of the engineering department of the Atlantic Refining Co. and the Gray Processes Corp. in the design of the Gray installation.

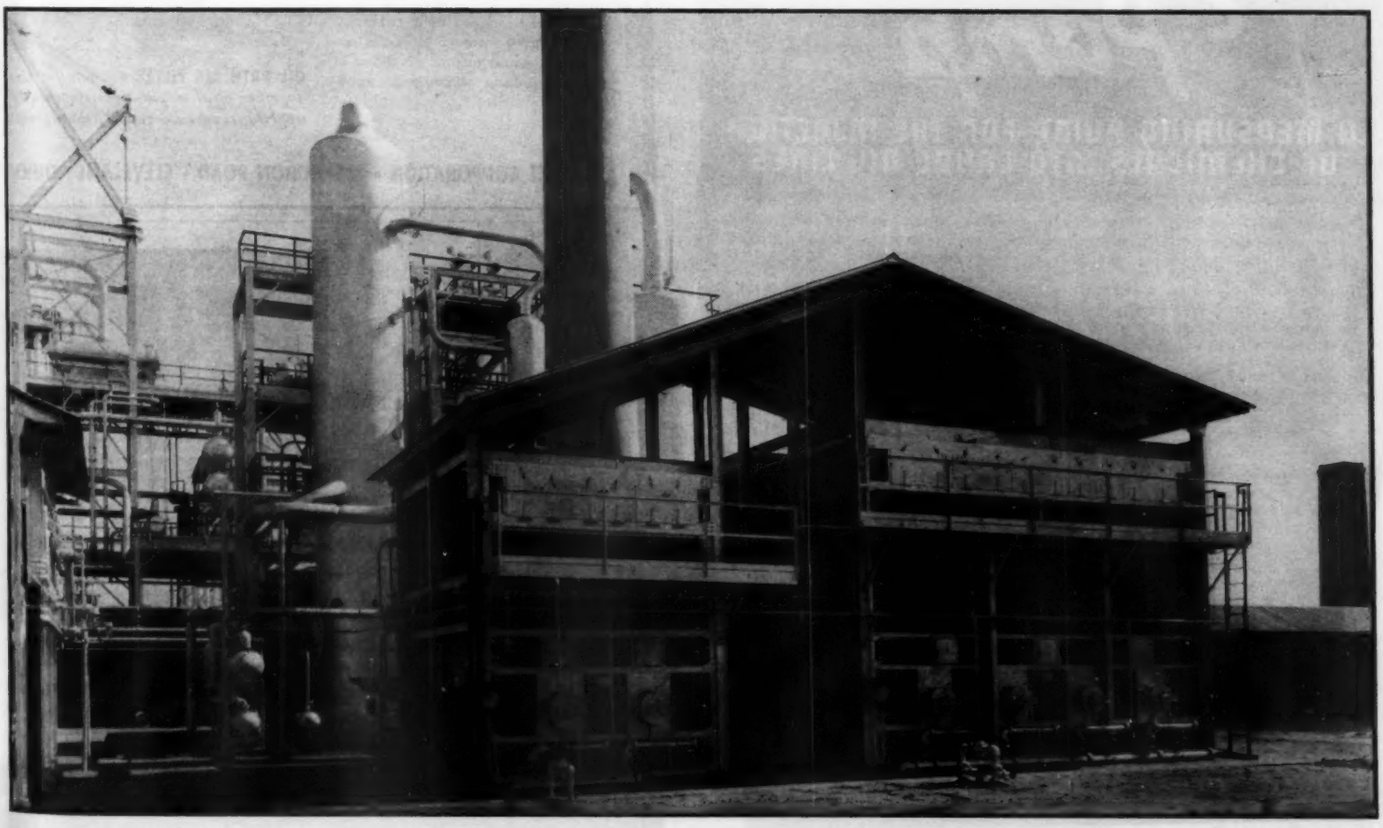
Most Gray clay treating installations are provided with a minimum of clay handling equipment (usually a hoist and large capacity clay bucket are considered sufficient), because of the long intervals between discharging and recharging the towers. However, Atlantic felt that the importance of maintaining as high an operating time factor as possible on the cracking unit warranted the cost of virtually completely mechanized clay charging facilities, mainly as insurance against delays in putting the cracking plant back on stream should labor shortage or weather difficulties prolong the time needed to change clay.

The clay handling equipment comprises a pneumatic conveyor and separator built by the Fuller Co. This is provided with a multiple stage receiver so that separation and suction are performed simultaneously. The fuller's earth used in the towers is supplied by the Attapulgus Clay Co., and received from the mines in Georgia in bulk carload shipments. The pneumatic conveyor lifts the clay from the cars and discharges it, at the rate of approximately seven tons per hour, into the two overhead bins shown in the photograph. The combined capacity of these bins is 100 tons, enough to furnish a complete charge to the three Gray towers, thus making it possible to anticipate a clay change well in advance, by supplying clay storage facilities at the unit. As will be observed on close inspection of the photograph, the bins are so arranged that either one can be used to charge the middle Gray tower, while each serves one of the end towers.

Spent clay from the Gray towers is discharged through the manheads shown at the sides of each tower, and thence through the chutes and is carted away in trucks.

The three Gray towers are operated in parallel, the vapor stream from the cracking unit being split into three equal portions for passage through the clay and then recombined before entering the polymer bubble tower or afterfractionator, which is just behind the right hand Gray tower from the point at which the picture was taken.

The combination unit has been operated on various charging stocks, largely from East Texas and South Texas crudes. The cracked gasoline vapors are clay treated at 225 pounds pressure and 450° F.



One of the first large solvent refining units built in the United States was erected at Beaumont, Tex., by the Magnolia Petroleum Company and above is shown the dual furnace that serves this unit. In the background are the exchangers, contacting towers and pump house

Accurate comparison of gasoline yields from the unit before and after installation of the clay towers is difficult. However, no evidence of operating loss due to clay treating is apparent. The Gray Processes Corp. explains this as being due in part to recycling and recracking of Gray tower polymers, and in part to the conversion of gases to hydrocarbons boiling in the gasoline range, the two factors combined operating to offset any loss due to heavy polymers discharged from the system.

Solvent Refined Oils Placed on Market in British Isles

The past year has been noteworthy for the introduction on the British market of the first of the modern solvent-extracted lubricating oils, according to The Petroleum Times. This was the "New Mobiloil" oils (April 6th) of the Vacuum Oil Co., Ltd., produced in the United States by the Clearosol (also known as the Duo-Sol) process. The company later introduced a range of Mobiloil "Extreme Pressure" lubricants for back-axles and suchlike.

In March, Messrs. C. C. Wakefield & Co., Ltd., introduced their "New Castrol" oils. The chief departure consists in the introduction of small quantities (up to 1 per cent) of oil-soluble compounds (e.g., oleates) of chromium and tin.

It is claimed that the working surfaces of an engine are protected by the deposition of a film of chromium, particularly so far as the serious problems of cylinder and piston wear are concerned, and that the tin compounds act as oxygen inhibitors and so delay formation of sludge and gum in the lubricating oil. Tetraethyl lead is also incorporated to raise the temperature at which spontaneous ignition or cracking of the oil takes place.

The current year should be interesting for the introduction by "Shell" and Herbert Green & Co. of their new brands of solvent-extracted lubricants.

The rapid advance of the solvent-extraction method of manufacture has caused and is causing considerable concern to many in the industry. It may yet lead to further plant construction in the country. At the same time many believe that the growing tendency is to supply oils of unnecessarily high quality; that for many purposes oils of lower grade would function equally well, and that this is an urgent problem for engineers to consider.

So far as the British market in lubricating oils is concerned, it still remains the most unsettled section, as for many years in the past. Price-cutting remains excessive and there is the minimum of cooperation between the various sections of the trade.

During the year the National Lubricating Oil and Grease Federation announced that it had been decided to drop the proposal to request the government to consider the institution of an import-licensing system. It was believed at first that this seemed the only means whereby conditions in the trade could be remedied, but expert opinion demonstrated how extremely difficult such a scheme would be to work out and, for that reason primarily, it would never have been countenanced by the government. At the annual dinner of the federation a plea was put forward for the support of the major companies to enable this body to carry greater weight of influence in the lubricating oil trade than is possible at present and so long as there is no united front on the part of all firms of repute.

It is understood that discussions have since

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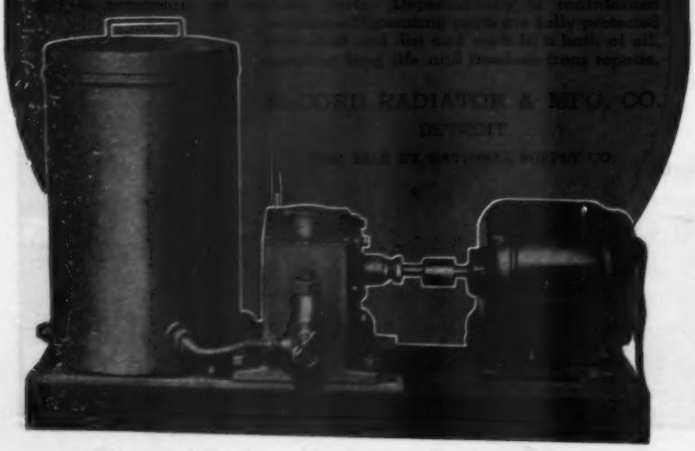

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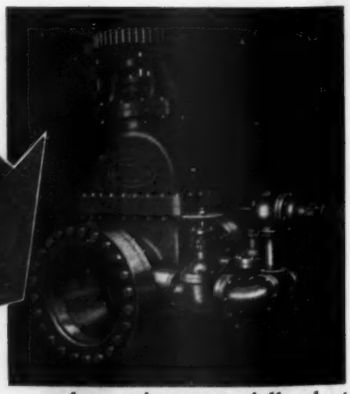

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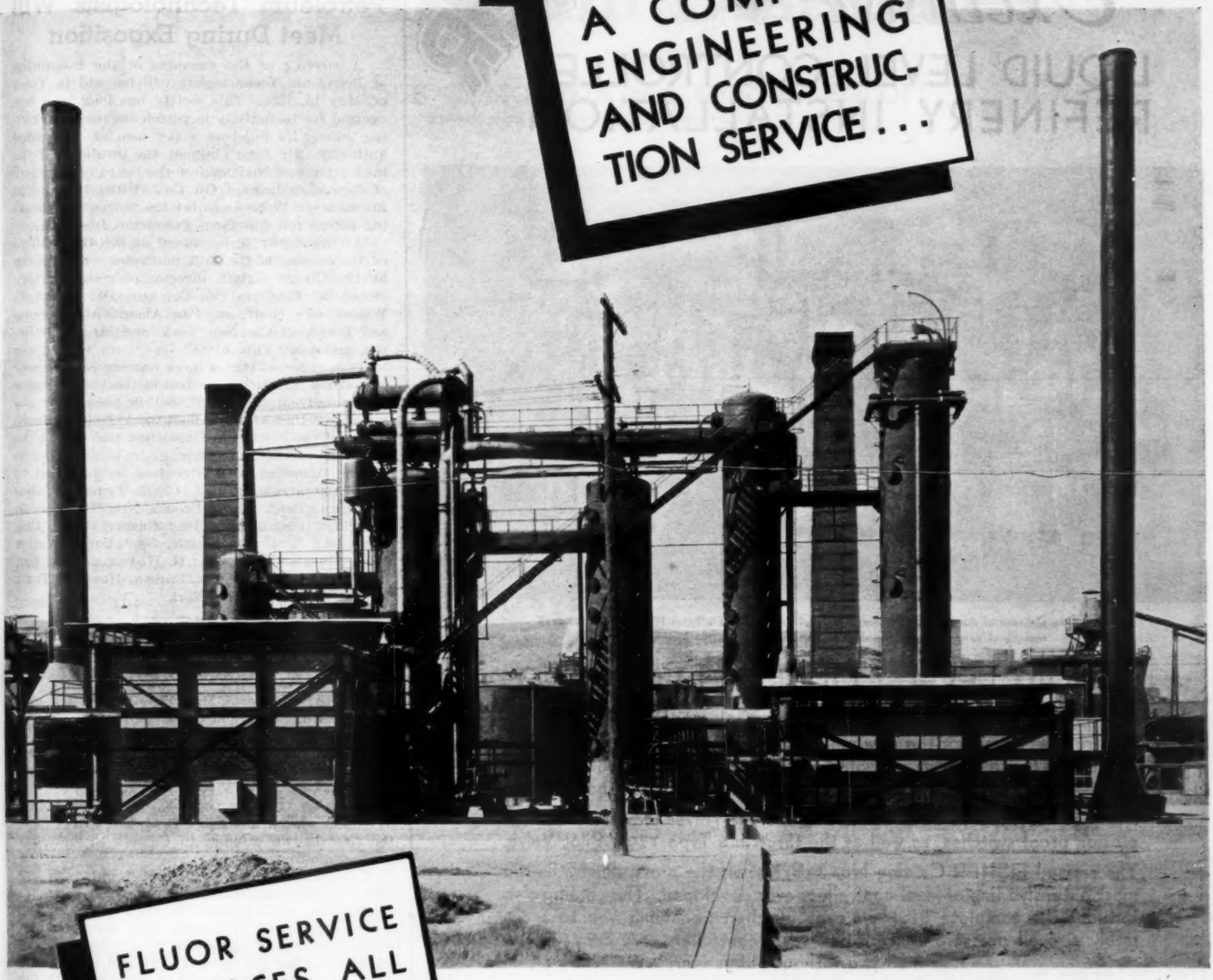

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The picture above shows only eighteen of the FISHER Automatic Controls furnished for the new stabilizing unit in the Kirkuk field, Iraq. To operate the diaphragm control valves shown, there was an equal number of FISHER Type No. 234C Internal Float Control Units, as shown below.

Many of the Type 234C's included Quadrant Travel Indicators and explosion proof switches, as well as the throttling Type 779K Pilot Valve.

The revised FISHER Catalog No. 34B, just off the press, illustrates the most extensive line of level controllers ever developed. This catalog also includes the complete FISHER capacity charts, enabling you to accurately size all pressure controls and level controllers. A copy will be furnished you without obligation.

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taken place between the two groups to explore possibilitites of cooperation. Nothing has been revealed officially as to what results were achieved, but it is doubtful if there is any workable solution owing to the excessively disorganized conditions among the innumerable members of the lubricating-oil distributing business.

Petroleum Technologists Will Meet During Exposition

A meeting of the members of the Institution of Petroleum Technologists will be held in Tulsa on May 15, 1936. This society has long been recognized for its activity in petroleum research, having among its numbers many men of recognized authority. Sir John Cadman, the president of the institution and chairman of the board of directors of the Anglo-Iranian Oil Co., visited the United States several years ago for the purpose of speaking before the American Petroleum Institute.

At the dinner to be served at the Hotel Mayo on the evening of the 15th, addresses will be given by Dr. Gustav Egloff, director of research, Universal Oil Products Co., Chicago; Dr. Robert E. Wilson, vice chairman, Pan American Petroleum and Transport Co., New York, and Mr. E. DeGolyer, president, Filmont Oil Co.

It is expected that a large number of the members of the institution resident in the United States and some from abroad who will be present for the spring meeting of the American Petroleum Institute and the Petroleum Exposition will attend the meeting.

The following committee has been formed to make the arrangements: C. K. Francis, Tulsa, chairman; Benjamin T. Brooks, New York; T. G. Delbridge, Philadelphia, Pa.; Gustav Egloff, Chicago, Ill.; K. G. MacKenzie, New York; Walter Miller, Ponca City, Okla.; G. H. van Senden, San Francisco, Calif.; John R. Suman, Houston, Tex.; Robert E. Wilson, New York.

Gas Storage in Bow Island Is Now 8,000,000,000 Feet

CALGARY, Alberta, Mar. 17.—P. D. Mellon, general superintendent and chief engineer of the Canadian Western Natural Gas, Light, Heat & Power Co. states that the repressuring of the depleted Bow Island field with waste gas from Turner Valley has been a success, and that up to the end of December, 1935, some 8,000,000,000 feet of gas have been stored in the old field. The project was the first known attempt in Canada to store gas underground.

Experiments were first carried out with gas from the adjacent Foremost field, when some 37,000,000 feet were forced into eight wells, raising the rock pressure 30 pounds. The Dominion government thereupon cooperated by an order-in-council withdrawing the rights to file and drill on approximately 20 square miles of acreage. With the further cooperation of the Canadian Pacific Railway and the provincial government in the matter of leases and rentals, and of Royalite Oil Co. which supplied the residual gas, the actual storage project was then worked out in detail.

Of 27 wells in the field, 18 were sealed, while the nine others were reconditioned and made available for receiving and repressuring purposes. Transmission and field lines were reconditioned and a compressor plant erected capable of handling 5,000,000 feet of gas daily. This work was completed early in the summer of 1930, and on August 4 of that year the pumping of Turner Valley gas into the Bow Island field commenced. The Canadian Western company's main transmission line, which originally supplied gas from the Bow Island field to Calgary, was utilized.

Since that time, with minor interruptions each year for repairs and observations, the repressuring has been practically continuous. So far the project has cost the consumers nothing outside a small charge for amortization and bond interest.

The Bow Island field originally covered 30 square miles, but due to the withdrawals of large quantities of gas and the encroachment of edge water, it is now about 16 square miles in extent. The field originally contained 44,000,000,000 feet and 39,000,000,000 feet were withdrawn.

Chemical Processes in Refining of Petroleum Distillates

By JACQUE C. MORRELL and GUSTAV EGLOFF
Research Laboratories, Universal Oil Products Co.

Approximately one billion barrels (966,243,000) of crude oil were produced during 1935, from which a total of 427,120,000 bbls. of gasoline were produced consisting of 219,583,000 bbls. of straightrun gasoline and 207,537,000 bbls. of cracked gasoline. It is significant that the cracked gasoline showed an increase of 13 per cent over 1934, whereas the straightrun gasoline increased only 6 per cent. From these data one may readily conclude that the problem of refining this gasoline to meet specifications and requirements is a most important one. It is likewise important that the process selected should attain the objective and the results desired in the most economical manner since even small savings on each barrel of gasoline refined will result in very large savings overall because of the great magnitude of the industry. During the past five years there has been a great movement in the direction of economy in refining to the point of its elimination in some cases without sacrifice of essential quality.

The present paper deals with the refining of petroleum distillates generally, but more specifically with the refining of cracked distillates since owing to their more complex composition, the refining methods which may be employed for them are applicable also to straightrun gasoline.

The processes selected for special discussion have attained the dignity of actual commercial practice, although there are many others which are now being developed which will no doubt assume great importance in the near future. The paper has been divided into sections, each one of which relates to the subject as a whole, but which is at the same time practically independent of the others.

The chemical composition of cracked gasoline is influenced by the type of crude oil and the fractions therefrom subjected to cracking and by the conditions of treatment, namely, the temperature, pressure and time. The composition of crude oils is so complex that no complete analyses have been made of any single petroleum. Even the lower boiling components, which are relatively easily determined compared with the higher boiling fractions, have been only partially investigated.

Since the composition of petroleums and their fractions has such a marked bearing on the composition of the cracked gasoline produced therefrom, it is considered important to submit a brief review of the work done in this connection.

Rossini and co-workers[1] determined the chemical constitution of the major part of the fraction of a Mid-Continent gasoline boiling below 180° C. They identified and isolated 35 hydrocarbons. Variations in the different general methods of fractionation were employed, including alteration of pressure from 760 to 0.001 mm. mercury; the addition of another substance permitting fractionation of a constant boiling mixture; crystallization, both by simple refrigeration and with the use of a suitable solvent; adsorption; and extraction. Table 1 shows the hydrocarbons isolated by Rossini and co-workers.

The Oil and Gas Journal wishes to call special attention to the following treatise prepared by Dr. J. C. Morrell and Dr. Gustav Egloff. The work covers every important method used in refining petroleum distillates and because of the exhaustive treatment given the subject by these authorities it is necessary to present but a portion of it here and the remainder of the article will be published in early issues.

Fenske, Quiggle and Tongberg[2] fractionated a 262° C. endpoint straightrun Pennsylvania gasoline. The curves plotted from these fractionations show alternate peaks and depressions corresponding to alternate aromatic and paraffinic fractions which had relatively high and low antiknock value, respectively. Fractions approximating 19 pure materials were separated. The purity of the fractions was estimated from their boiling points and refrative indexes. There was no analysis for olefins.

Numerous other workers have separated or attempted to separate pure hydrocarbons from petroleum. Anderson and Erskine[3] analyzed natural gas gasoline and with eight fractionations were able to separate pentanes, hexanes and heptanes. Brown and Carr[5] separated cyclopentane, cyclohexane, benzene, toluene, pentanes, n- and iso-hexanes, n-heptane, n- and iso-octanes, and n-nonane, from a commercial straightrun gasoline from the Cabin Creek crude. They employed a fractionating column 18 feet high packed with modified Raschig rings.

The early workers employed simple stills for fractionation and their separation of pure compounds is therefore questionable. Among them were Pelouse and Cahours[4], Schorlemmer[5], and Beilstein and Kurbatow[6]. The results of these workers, as would be expected from the type of apparatus used, were not satisfactory. Later workers, among whom were Warren[7], Mabery[8], Young and Thomas[9], and Young[10], employed fractional condensers or dephlegmators. Bushong[11] also employed a special type dephlegmator. Evans[12] used several different types of fractionating columns and the results of these various workers were an improvement upon earlier work.

In addition to hydrocarbons of the various groups, petroleums contain compounds of sulfur, oxygen and nitrogen, which should be found in the distillates resulting from the cracking of petroleum and its fractions.

Sulfur is found in various combinations and to a varying extent in practically all petroleums. Its presence has been considered generally undesirable because compounds such as mercaptans and hydrogen sulfide are odoriferous and corrosive. Elemen-

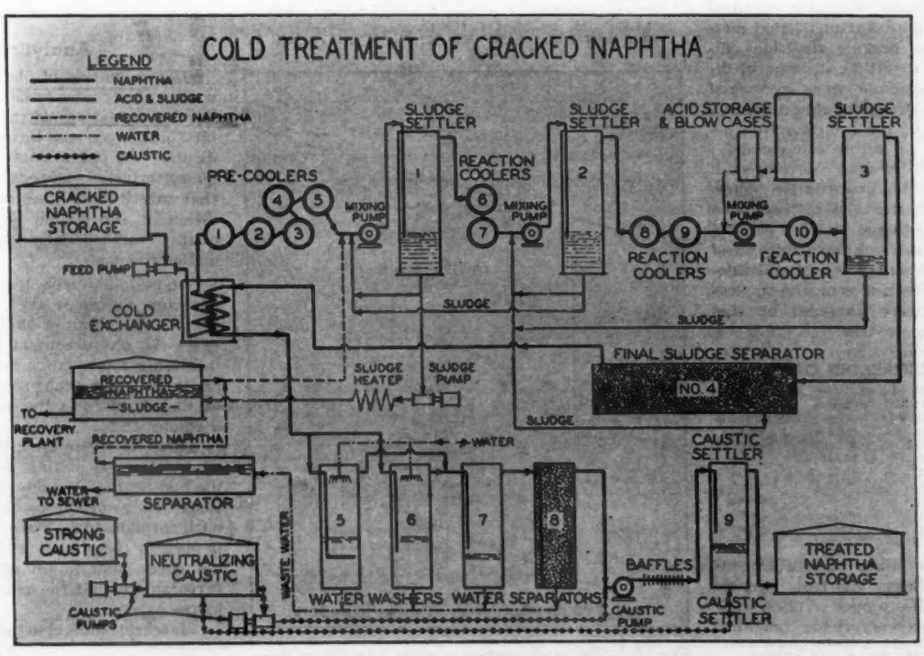

Fig. 1—Flow diagram of the low temperature process of treating cracked distillates. Advantages of this method are that it serves the purpose of effecting partial desulfurization with a substantial reduction in the polymerization and reaction solution losses

[1]Project No. 6, A.P.I. May 15, 1935.

[1]J.I.E.C., 24, No. 5, 542-6 (1932).
[2]J.I.E.C., 16, 263 (1924).
[3]A.C.S., Tulsa, Okla., April 5-9, 1926.
[4]Compt. rend. 54, 1,241 (1862); 56, 505 (1863); 57, 62 (1863).
[5]J. Chem. Soc. (London) 15, 419 (1863).
[6]Ber., 13, 2,028 (1880).
[7]Proc. Am. Acad. Arts Sci., 27, 56 (1891); 34, 92 (1898).
[8]Proc. Am. Acad. Arts Sci., 31, 10 (1895).
[9]J.A.C.S. (London), 71, 440 (1897).
[10]Ibid.
[11]J.I.E.C., 6, 888 (1914).
[12]J. Soc. Chem. Ind., 38, 401T (1919).

tary sulfur and its compounds when present in gasoline generally contribute to corrosion of the motor and its parts. If corrosion occurs at all, the extent or degree to which it occurs depends upon the nature and per cent of sulfur present as well as upon the temperature and other conditions of motor operation.

Thiophenes, hydrothiophenes, sulfonic acids, alkyl sulfates, alkyl sulfides and mercaptans were among the first sulfur compounds separated from petroleum.

Borgstrom and Reid[1] compiled a list of the types of sulfur compounds that have been identified in petroleum:

Sulfur.
Hydrogen sulfide.
Sulfuric acid.
Alkyl sulfates.
Sulfonic acids.
Carbon bisulfide.
Alkyl mercaptans.
Aryl mercaptans.
Alkyl sulfides.
Cyclic sulfides.
Thiophene.

Some work has been done in regard to the pyrolysis of sulfur compounds, the distribution of sulfur in the various products of cracking, and the determination of sulfur compounds in cracked distillates, which is discussed below:

Faragher, Morrell and Comay[2] investigated the thermal decomposition of organic sulfur compounds, with the following conclusions: The thermal decomposition of mercaptans produces hydrogen sulfide and elementary sulfur. Hydrogen sulfide, mercaptans and thiophene-like products are produced when sulfides are thermally decomposed. The disulfides produce hydrogen sulfide, elementary sulfur, sulfides and thiophene-like derivatives. Thiophenes undergo no decomposition even at temperatures of 1,600° F. The compounds formed (and their relative proportions) from the thermal decomposition of the organic compounds of sulfur depend upon the temperature, time and the usual factors which determine the course of a chemical reaction.

Egloff and Morrell[3] showed the distribution of sulfur in the cracking of a Mexican gas oil as follows:

TABLE 2—DISTRIBUTION OF SULFUR

	Per cent sulfur— By weight	Of total
Charging stock	2.19	100
Pressure distillate	1.40	23.05
Residuum	3.84	62.08
Coke	5.22	2.01
Gas	8.5	12.9

Birch and Norris[4] separated the following sulfur compounds from the light distillate obtained from the crude oil of Maidan-i-Naftun: Ethyl mercaptan, isobutyl mercaptan, organic disulfides, diethyl sulfide, di-isopropyl disulfide, di-isobutyl disulfide. The sulfur compounds were recovered from spent soda used in washing the distillate, the yield from 40 gallons of the soda solution being 720 c.c. (0.19 gallon) of sulfur compounds.

Faragher, Morrell and Monroe[5] developed a systematic procedure for the quantitative determination of sulfur and sulfur derivatives from petroleum distillates as hydrogen sulfide, elementary sulfur, mercaptans, sulfides, disulfides, and different so-called residual sulfur comprising thiophenes and other types of sulfur compounds. Several untreated gasolines were analyzed by this method, with the following results:

TABLE 3—ANALYSIS OF UNTREATED GASOLINES

	Cracked gasoline— California (Midway) crude per cent	Smackover crude per cent	Straightrun gasoline Panhandle crude per cent
Sulfur—			
Elementary	none	none	0.05
Mercaptan (titration)	0.02	0.02	0.04
Disulfide	0.11	0.03	none
Sulfide	0.02	0.00	none
Residual	0.95	0.15	none
Hydrogen sulfide	present	present	present

Morrell and Egloff[6] determined the sulfur content of about 30 different heavy oils from various fields, comprising crude oils, topped crudes, fuel oils and distillate fractions comprising cracking stocks, to correlate the sulfur content in the charging stock with the per cent of sulfur in the cracked distillate and in the treated gasoline.

In a later paper these same authors[7] showed the distribution of sulfur in cracked distillates, both untreated and treated, and the effect of sulfuric acid concentration and temperature of treatment upon the removal of sulfur from the distillate.

[1]The Oil and Gas Journal, 26, No. 4, 252 (1927).
[2]J.I.E.C. 20, 527-32 (1928).
[3]Chem. and Met. Eng., 28, No. 14, 632-35 (1923).
[4]J.A.C.S., 127 898 (1925).
[5]J.I.E.C., 19, 1,281-84 (1927).
[6]The Oil and Gas Journal, No. 43, p. 150 (1927).

TABLE 1—HYDROCARBONS ISOLATED

Number	Formula	Hydrocarbon	Est. % in crude (see text for explanation)	Purity of best sample (mole %)	Published in R.P. No.*
		Paraffinic			
1	CH_4	Methane	(†)	(†)	...
2	C_2H_6	Ethane	(†)	(†)	...
3	C_3H_8	Propane	(†)	(†)	...
4	C_4H_{10}	n-Butane	(†)	(†)	...
5	C_5H_{12}	n-Pentane	(†)	(†)	...
6	C_5H_{12}	2-Methylbutane	(†)	(†)	...
7	C_6H_{14}	n-Hexane	0.5	98.3	239, 311
8	C_6H_{14}	2, 3-Dimethylbutane	... 0.3	95	239, 311
9	C_6H_{14}	2-Methylpentane			
10	C_6H_{14}	3-Methylpentane			
11	C_7H_{16}	n-Heptane	0.9	99.9	432
12	C_7H_{16}	2, 2-Dimethylpentane	0.03	54	458
13	C_7H_{16}	2-Methylhexane	0.25	99.9	542
14	C_7H_{16}	3-Methylhexane	(‡)	(‡)	...
15	C_8H_{18}	n-Octane	1.0	99.1	282
16	C_8H_{18}	2-Methylheptane	0.15	97	552
17	C_9H_{20}	n-Nonane	1.0	99.9	383
18	C_9H_{20}	2-Methyloctane	(‡)	(‡)	...
19	C_9H_{20}	2, 5-Dimethylheptane	(‡)	(‡)	...
20	$C_{10}H_{22}$	n-Decane	0.8	99.99	438
		Naphthenic			
21	C_5H_{10}	Cyclopentane	(†)	(†)	...
22	C_6H_{12}	Methylcyclopentane	0.2	98.9	375
23	C_6H_{12}	Cyclohexane	0.3	99.98	360
24	C_7H_{14}	Methylcyclohexane	0.3	99.9	432
25	C_7H_{14}	1, 1-Dimethylcyclopentane	0.04	95	542
26	C_8H_{16}	1, 3-Dimethylcyclohexane	0.15	98	...
27	C_8H_{16}	Ethylcyclohexane	0.1	95	...
28	C_9H_{18}	Nonanaphthene	0.1	99	745
		Aromatic			
29	C_6H_6	Benzene	0.08	99.8	311
30	C_7H_8	Toluene	0.3	(†)	280
31	C_8H_{10}	p-Xylene	0.04	99.9	501
32	C_8H_{10}	o-Xylene	0.12	99	501
33	C_8H_{10}	m-Xylene	0.12	99.9	501
34	C_8H_{10}	Ethylbenzene	0.03	94	554
35	C_9H_{12}	Hemimellitene	0.06	99.95	614
36	C_9H_{12}	Pseudocumene	0.2	99.9	614
37	C_9H_{12}	Mesitylene	0.02	99.95	614

*R.P. No. = Research Paper No. These papers are sold at nominal prices by the Superintendent of Documents, Government Printing Office, Washington, D. C.
†Not determined.
‡Determination in progress.

Phenols

The presence of phenols in cracked distillates has been noted by several workers, notably Brooks and Parker[8] and Catlin[4]. Catlin extracted cresylic acid from petroleum distillates and showed that ortho, meta and para-cresols are present and may be recovered from the caustic wash of cracked distillates by acidification of the same. The presence of methylphenylcarbinol is also indicated.

Morrell and Egloff[3] show that lower boiling phenols are produced from the cracking of higher boiling phenols in addition to neutral oils and water. These lower boiling phenols will therefore be present in the gasoline fraction resulting from the cracking of the higher boiling phenols in charging stocks containing them.

Nitrogen Compounds

Bailey[1] has presented a review of the previous literature on the subject of nitrogen compounds in petroleum, special emphasis being placed on the classic work of Mabery and Wesson.[2] The references are quoted which indicate that German petroleums are substantially free from nitrogen, that Caucasian oils contain 0.05 per cent, Rumanian oils 0.09 to 0.12 per cent, and Pennsylvania oils only 0.008 per cent, and that the petroleums of Japan, Ohio and California are rich in nitrogen compounds. The latter contain as high as 2.3 per cent total nitrogen, corresponding to about 30 per cent of nitrogen compounds. After an extensive review of the analytical work done on the determination of amount and character of the nitrogen compounds in petroleum, it is concluded that they are principally methylated quinolines, particularly trimethyl quinoline and hydrogen quinolines. The evidence indicates that none of the alkyl-substituting groups represent a long chain since there is an absence of propionic, butyric or higher fatty acids in the permanganate oxidation products of the separated compounds. There is evidence that the highest molecular weight nitrogen compound in crude from Santa Paula, Calif., has heptamethyl quinoline.

Very little of a definite nature is known about the nitrogen compounds in cracked gasoline.

Morrell and Egloff[3] indicate that the nitrogen bases present in higher boiling hydrocarbons such as coal tars when cracked would produce lower boiling nitrogen bases which will be found in the gasoline fraction. This, no doubt, also applies to corresponding petroleum fractions.

Hydrocarbons in Cracked Distillates

Practically all of the work on the chemical composition of cracked gasolines has been directed to the determination of hydrocarbon groups rather than individual compounds. The determination of these groups depends entirely upon the analytical method employed. These methods are quite numerous and the details of them cannot be given here. The four groups of hydrocarbons of principal interest in connection with the composition of cracked gasolines are the unsaturated, aromatic, naphthene and paraffin hydrocarbons.

Analytical Methods

Determination of olefins—One of the most common methods used to determine olefins is halogenation. Modifications of the procedures used for fatty oils have been employed, but while they are indicative of olefin content they have not proved quantitatively successful. The main difficulty is that substitution takes place concurrently with addition at the double bond. Various modifications of these methods have been proposed to correct the difficulties met.

At best, however, the results obtained by halogenation represent the "concentration" of double bonds rather than of olefinic hydrocarbons. In such cases the olefin content may be calculated by determining the average molecular weight of the oil and by assuming that the average molecular weight of the olefins was the same as that of the oil as a whole.

Other methods have been employed for the determination of olefins, for example, the formolite method which depends upon the formation of a resin when an oil containing olefins is refluxed with formaldehyde and a strong acid. This method is open to the objection that the resin formed does not correspond to all of the olefins present and furthermore that the reagent reacts with aromatic hydrocarbons.

Mercuric salts, particularly the acetate, react

[7]World Petroleum Congress, London, July 24, 1933.
[8]J.I.E.C. 16, No. 6, 587 (1924).
[4]Ref. and Natr. Gaso. Mfr. 5, No. 4, 25 (1926).

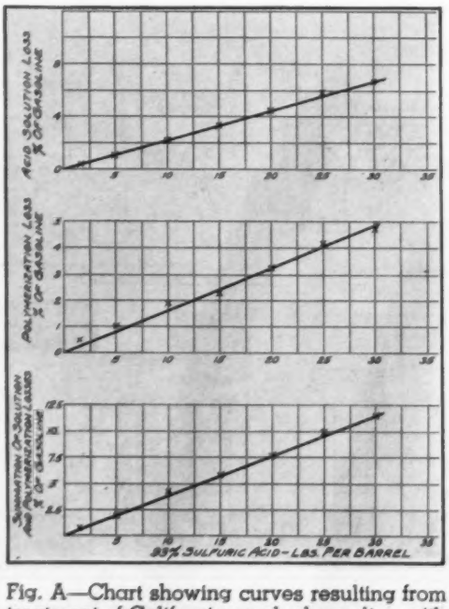
ACID SOLUTION LOSS % OF GASOLINE
POLYMERIZATION LOSS % OF GASOLINE
SUMMATION OF SOLUTION AND POLYMERIZATION LOSSES % OF GASOLINE
93% SULFURIC ACID - LBS. PER BARREL

Fig. A—Chart showing curves resulting from treatment of California cracked gasoline with varying amounts of sulfuric acid to determine polymerization and acid solution losses

[1]Second Int. Conf. on Bituminous Coal Proc. 2, 580, 613 (1928).
[3]Ref. and Nat. Gaso. Mfr., 4, No. 9, 46 (1925).
[2]J.A.C.S., 43, 1,014 (1920).
[2]Second International Conference on Bituminous Coal Proc. 2, 580, 613 (1928).

with olefins, and several methods of analysis have been devised for the determination of olefins based upon this reaction. A large excess of mercuric acetate must be used to cause all of the olefins to react and refluxing is necessary. Some of the unchanged oil is retained mechanically by the flocculent precipitate that forms.

Advantage has been taken of the heat of reaction of the olefins with sulfuric acid to determine the relationship between the percentage of olefins present and the quantity of heat evolved. This is not an accurate method for the determination of olefins in cracked gasoline. Furthermore, strong sulfuric acid reacts with aromatic hydrocarbons and to some extent with naphthenes and paraffins, and causes alkylation as well as polymerization and the various other reactions which occur with sulfuric acid and which will be referred to below. The problem is further complicated since each olefin has its own heat of reaction with sulfuric acid.

Various solvents have been employed to separate olefin and aromatic hydrocarbons from other hydrocarbons, and some difficulties are encountered in the application of these methods of analysis. The separation of the olefins and the aromatic hydrocarbons is usually incomplete, and the paraffin and naphthene hydrocarbons are dissolved to some extent. Some of the solvents which have been used are liquid sulfur dioxide, a solution of sulfur dioxide in acetone and other ketones, sulfoacetic acid, dimethyl sulfate, selenium oxychloride, methanol, acetic anhydride, aniline, nitrobenzene, dimethylaniline, ethyl tartrate, ethyl oxalate, acetoacetic ester, levulinic acid, phenylhydrazine and furfural. In some cases fairly sharp separation may be made if the correct quantity of reagent is used and the percentage of olefin and aromatic hydrocarbons lies within certain limits.

Perbenzoic acid has been found to react with olefins and diolefins and other unsaturated compounds at low temperatures, and this reaction has been used as the basis of a method for the quantitative estimation of olefins.

Sulfuric acid is perhaps the most widely used reagent for the determination of hydrocarbon groups. It reacts with olefins to give five principal types of products, namely, alcohols, esters, polymers, oxidation products, and saturated hydrocarbons by reduction. Alkylation also occurs to a considerable extent when the other groups of hydrocarbons are present. The extent to which each of these reactions takes place is a function of the molecular weight and structure of the olefins, and the concentration of the acid. Polymerization increases with increase in molecular weight and up to a certain point would increase with the concentration of the acid, the maximum polymerization taking place in the presence of approximately 91 per cent acid. The alcohols that are formed directly are tertiary alcohols, which originate from tertiary olefins shown to be the most reactive. The separation of olefins and aromatic hydrocarbons is complicated further because these hydrocarbons condense with the formation of alkyl derivatives of the aromatic hydrocarbons. However, approximate separations may be made by various concentrations of acid. Acid having the strength of 80 per cent has been most generally proposed because it has very little action on the aromatic hydrocarbons. However, all of the olefins are not removed. Sulfuric acid stronger than 80 per cent has been proposed but is open to the objection of reaction with aromatic and alkylation of hydrocarbons.

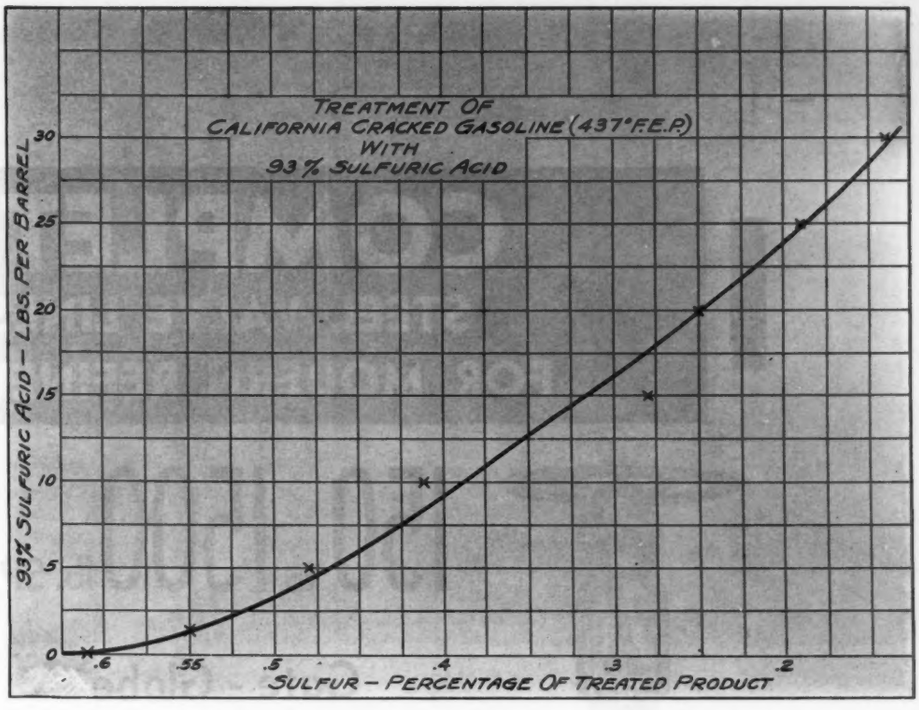

Fig. B—Reductions in sulfur content resulting from treatment of cracked California gasoline with varying amounts of 93 per cent sulfuric acid

Determination of Aromatic and Naphthene Hydrocarbons

Aromatic hydrocarbons may be determined by physical as well as chemical methods. The physical methods employed are density, index and refraction, and critical solution temperatures in various organic liquids. In general, the aromatic hydrocarbons have a much higher density and index of refraction than the other hydrocarbons. Also, they show an increase in the total volume when mixed with paraffin hydrocarbons, although this increase varies for the specific aromatic and paraffin hydrocarbons.

Various organic liquids have been found with which paraffin and naphthene hydrocarbons are not miscible at room temperature but in which the aromatic hydrocarbons dissolve readily. When aromatic hydrocarbons are dissolved in a mixture of paraffin and naphthenes the temperature at which complete miscibility with the solvent occurs is lowered. The higher the concentration of the aromatic hydrocarbons the greater is the lowering of the solution temperature. The solvent most widely used for this test is aniline. Another solvent used is nitrobenzene. This method furnishes a basis for the determination of naphthene hydrocarbons.

The chemical methods employed for the determination of aromatic hydrocarbons make use chiefly of sulfonation and nitration. Sulfuric acid of 98 per cent strength has been used widely for sulfonation. Nitration is also a commonly used method for the determination of aromatic hydrocarbons wherein fuming nitric acid is employed and the nitrated products dissolved in a known volume of sulfuric acid. The better method consists in the use of a nitration mixture of nitric and sulfuric acid so chosen that the nitro compounds concentrate in a separate layer, the volume of which is proportional to the concentration of aromatic hydrocarbons in the oil.

Widely Used Methods for Hydrocarbon Group of Analysis of Gasolines

None of the methods of analysis which have been developed are beyond criticism. All of them have limitations. Those most widely used are shown below:

Egloff and Morrell[1] developed a method of determining the unsaturated, aromatic, naphthene and paraffin hydrocarbons in cracked gasolines and undertook to relate the percentage composition of the four hydrocarbon groups to the antiknock properties of motor fuels.

Unsaturated hydrocarbons were determined by distilling the motor fuel up to 210° C. and treating the distillate with two volumes of 80 per cent sulfuric acid, which is stated to be without substantial effect on pure aromatic hydrocarbons. Correction is made for the polymers boiling above 210° C.

The overhead to 210° C. obtained by redistillation of the 210° fraction on which the olefins were determined was treated with 2½ volumes of a nitration mixture consisting of 25 per cent nitric acid, 58 per cent sulfuric acid, and 17 per cent of water (which was found to be the optimum mixture) to determine aromatics. This forms a three-liquid layer system with unreacted oil at the top, nitro derivatives in the center, and acid sludge on the bottom. The percentage of aromatic hydrocar-

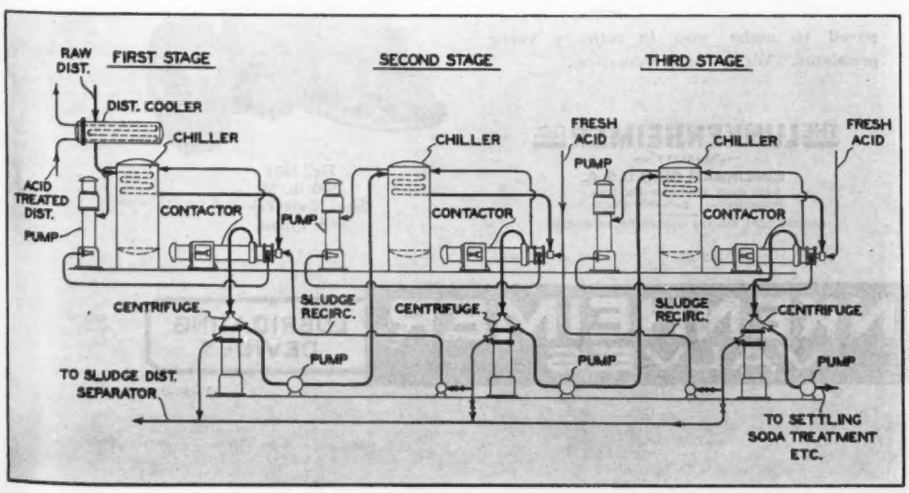

Fig. 2—Simplified flow diagram of the contactor-centrifuge acid treating method of processing petroleum distillates, the treatment being counter-current in three stages

[1] J.I.E.C. 18, No. 4, 354 (1926).

COMPLETE
STEEL VALVE LINES FOR MODERN REFINERIES

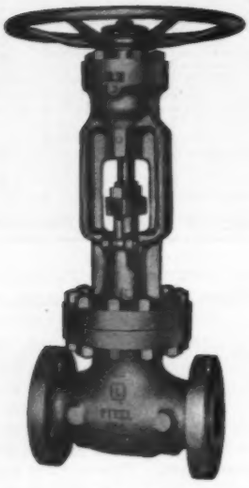

Fig. 1469
900 lb. SP
Steel Globe Valve

150 to 1500 lb. SP

Gate - Globe
Check - Non-return
and Blow-off

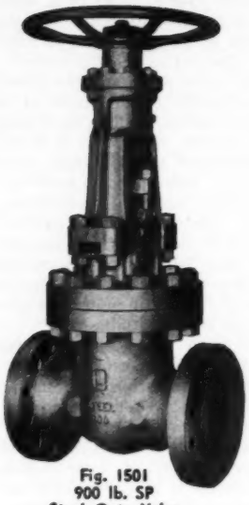

Fig. 1501
900 lb. SP
Steel Gate Valve

Lunkenheimer Steel Valves are designed in a variety of types and sizes and for all prevailing pressures and temperatures required by the Modern Refinery.

As no one combination of materials is suitable for all conditions, a choice of materials as well as types is available. Bodies and bonnets may be made of carbon or alloy steels, and trimmings of various alloys selected to suit the installation. Valves may be constructed for flanged or welded piping and equipped with motor control or gearing.

The Lunkenheimer Company is prepared to assist you in refinery valve problems. Write for information.

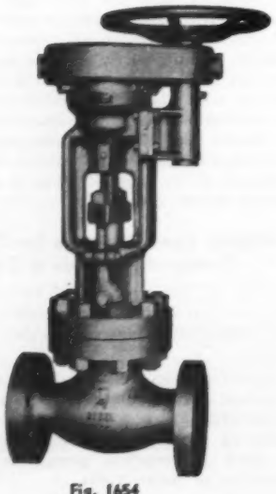

Fig. 1654
1500 lb. SP
Steel Globe Valve
with Gearing

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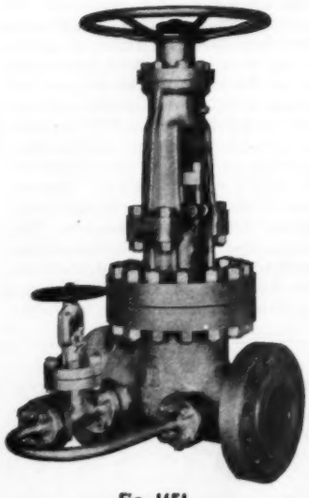


Fig. 1651
1500 lb. SP
Steel Gate Valve
with Bypass

BOILER MOUNTINGS — LUNKENHEIMER VALVES — LUBRICATING DEVICES

15-69-91

bons is calculated from the volume of the middle layer.

To determine naphthenes the residual oil from the nitration treatment is used for the determination of aniline point, assuming that paraffin hydrocarbons are completely miscible at 70° C. and that the aniline point is lowered 0.3° C. for each 1 per cent of naphthenes present. The paraffins are estimated by difference.

Table 4 shows analyses of cracked gasolines from various stocks using this method:

TABLE 4—ANALYSES OF CRACKED GASOLINES

Hydrocarbons—	Braman, Tonkawa, Kansas, topped crude	Kentucky fuel oil	Smackover heavy crude	North Texas fuel oil	Lost Soldier, Wyoming, crude
Unsaturated	16.1	14.4	14.7	16.0	11.7
Aromatic	17.8	22.5	27.5	18.6	15.0
Naphthene	12.8	10.0	21.2	11.7	15.4
Paraffin	53.3	53.1	36.6	53.7	57.9
Aromatic equivalent	24.2	27.9	36.7	24.7	21.2
Highest useful compression ratio	5.6	5.7	5.9	5.6	5.5

Garner[1] removes olefins from cracked gasoline by the addition of fuming nitric acid, and the aniline point of the remaining oil is used for the estimation of the percentage of paraffin and naphthene hydrocarbons. The iodine number of the original gasoline is also determined, using the Hanus solution. Several analyses made according to this method were reported by Garner. He concluded that recracking of the gasoline increases the percentage of naphthenes.

Faragher, Morrell and Levine[2] developed the following analytical procedure for the determination of olefin and aromatic hydrocarbons: (a) determination of the total olefin-aromatic content by treatment of the hydrocarbon distillate with 91 per cent sulfuric acid, distillation to remove polymers, and final treatment with 98 per cent sulfuric acid, and (b) removal of olefins with sulfur monochloride, distillation to remove the olefin-free oil and determination of naphthenes by the aniline point method and paraffins by difference.

Analyses of cracked distillate from representative oils showing the olefin and aromatic content are given in Table 5.

TABLE 5—ANALYSES OF CRACKED DISTILLATE

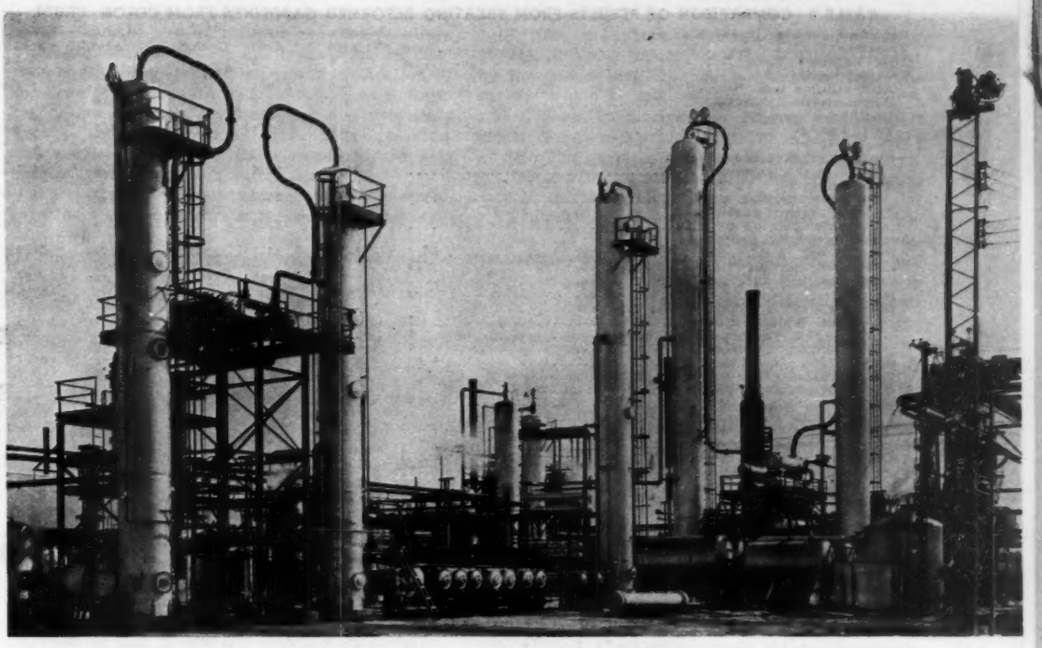
Oil—	Olefins	Aromatics
Smackover	31.1	14.4
Venezuela	20.6	17.8
Mexican (Panuco)	27.8	15.1
Panhandle	32.8	10.5
West Texas (Pecos)	30.8	14.1
California	21.4	14.1
Oklahoma (Seminole)	29.1	9.0
Pennsylvania (1)	25.5	9.9
Pennsylvania (2)	34.6	7.1

Morrell and Levine[3] proposed an approximate method for the determination of olefin and aromatic hydrocarbons which is accurate to within 1 to 3 per cent and which is considerably shorter than methods heretofore proposed. The sum of the olefins is determined by treatment with 91 per cent and 98 per cent sulfuric acid as described in Faragher, Morrell and Levine,[2] and the olefin concentrations may then be calculated from the weight of residue remaining after the distillation of the oil obtained upon treatment with 91 per cent sulfuric acid by the use of empirical formulas.

The Kattwinkel[1] method is also widely used for the determination of aromatics and olefins in oils. It is a rapid method and gives good results. The general principle of the method is that concentrated sulfuric acid containing small percentages of boric acid has no reaction on aromatics in mixtures but reacts with and removes olefins, while similarly sulfuric acid containing minor percentages of phosphorous pentoxide reacts with both aromatics and olefins to effect their removal. The reagent for determining both aromatics and olefins is made by adding 30 gr. of phosphoric pentoxide to 100 gr. of sulfuric acid, the phosphorous pentoxide being added gradually with stirring and cooling. The reagent for unsaturates alone is made by adding 5 gr. of boric acid to 100 cc. of concentrated sulfuric acid, heating if necessary to effect solution. Aromatics and unsaturates are determined together by using 30 cc. of the first reagent and 10 cc. of the oil in a nitration tube, shaking for five minutes with cooling and noting the percentage decrease in volume of the oil layer. Unsaturated hydrocarbons are determined by using the same proportions of the second reagent.

[1]J.I.P.T. 14, 695 (1928).
[2]J.I.E.C., Anal. Ed. 2, 18 (1930).
[3]J.I.E.C., 4, 321 (1932).

[2]J.I.E.C. Anal. Ed. 2, 18 (1930).
[1]Brennstoff-Chemie, 8, No. 22, 353 (1927).



Gasoline stabilizing equipment in the Houston refinery of the Shell Petroleum Corporation

TABLE 6—RESULTS OF TREATING A CALIFORNIA CRACKED GASOLINE WITH VARYING AMOUNTS OF ACID

Treatment—acid, lbs./bbl.	Untreated	1-1/2	5	10	15	20	25	30
Acid solution loss	....	0.30	1.0	2.3	3.4	4.4	5.8	6.7
Polymer. loss	....	0.50	1.0	1.9	2.3	3.2	4.1	4.7
Gravity, °A.P.I.	50.3	52.5	52.6	52.4	52.3	52.3	52.1	52.2
Color, °Saybolt	Red	Yellow	17	19	22	22	21	20
Color stability*	....	....	16	18	21	21	21	20
Gum, Mgs./100 cc. copper dish,								
Without inhibitor	472	232	38	13	6	6	8	7
With 0.025 per cent inhibitor	....	141	14	5	4	4	5	7
Sulfur, per cent	0.61	0.55	0.48	0.41	0.28	0.25	0.19	0.14
Octane number	76	74	72.5	72.5	72.0	72.0	71.5	69.5
100 cc. A.S.T.M. Distillation								
I.B.P., °F.	118	130	120	120	122	124	124	124
5 per cent	162	163	161	164	162	160	160	160
10 per cent	183	179	182	174	172	180	183	183
20 per cent	215	208	211	204	206	216	216	218
30 per cent	245	237	240	234	236	244	245	250
40 per cent	274	263	265	261	262	269	270	274
50 per cent	300	285	288	285	286	291	293	298
60 per cent	326	308	311	308	310	314	314	320
70 per cent	351	324	333	321	332	336	335	334
80 per cent	377	356	358	351	356	360	359	364
90 per cent	404	385	386	384	384	384	385	386
Endpoint, °F.	438	416	418	418	418	421	420	419
Oxygen bomb stability—induction period—minutes:								
Without inhibitor	600	220	555	All samples cut at 600 minutes				
With 0.025 per cent inhibitor	600	265	All inhibitor samples cut at 600 minutes					

*Equivalent to two hours noon June sunlight.

Influence of Cracking Conditions and Charging Stock on Composition of Cracked Gasoline

The chemical composition of cracked gasoline is influenced not only by the type of oil undergoing treatment but also by the conditions of treatment, namely, the temperature, pressure and time. Despite the large amount of work done to date, there is a big field for the systematic investigation of this subject. In fact, one may say that the field is scarcely scratched. Furthermore, practically no work has been done on the composition of cracked distillates from the viewpoint of the individual hydrocarbons contained therein.

In high temperature cracked gasolines the analytical methods already discussed and the hydrocarbon groups referred to are considered in the same manner as for cracked distillates produced at relatively low temperatures. In addition to the mono-olefins, the di-olefins become of increasing importance with cracked distillates produced at high temperatures. Birch and Scott[1] identified several di-olefins in the lower fractions from vapor phase cracked gasoline. Conjugated hydrocarbons were estimated quantitatively according to the method of Diels and Adler,[2] by the preparation of acid anhydrides formed by the addition of maleic anhydride to hydrocarbons with conjugated double bonds. These addition products are formed merely by allowing the di-olefin and maleic anhydride to react in benzene solutions at ordinary temperatures. The products are characterized by definite crystalline form and by their melting points. Butadiene, piperylene, isoprene and cyclopentadiene were all present and easily separated.

From the foregoing it is evident that while considerable work has been done on the composition of cracked distillates in respect to the hydrocarbon groups contained therein, namely, the paraffins, naphthenes, olefins and aromatics, our knowledge of the individual compounds in cracked distillates is meager. One may conclude from the group hydrocarbon analyses that the composition of cracked distillates varies as a function of cracking conditions, viz., temperature, pressure and time, to which the stock undergoing treatment had been subjected, and also the type of oil undergoing treatment. An investigation to determine the individual components of cracked gasolines would have to include a large number of distillates based upon the source of the charging stock as well as

[1]J.I.E.C. 24, No. 1, 49 (1932).
[2]Ann. 460, 98 (1928); 470, 101 (1929); 476, 102 (1929); see also Farmer and Warren, J.A.C.S. 1929, 897.

TABLE 8—COMPARISON OF RESULTS FROM TREATING REFORMED GASOLINES FROM COLON CRUDE

Reformed gasoline octane No.:	60			69		
Treatment	None	Acid	Acid	None	Acid	Acid
Acid, lb./bbl.	....	1	2	....	1	2
Treating losses:						
Acid solution loss, %	....	0.2	0.8	....	0.5	1.1
Polymerization loss, %	....	0.0	0.3	....	0.0	0.5
Distillation loss, %	....	0.8	0.3	....	0.5	0.2
Total loss, %	....	1.0	1.4	....	1.0	1.8
Yields:						
Finished cracked gasoline:						
Per cent raw gasoline	....	99.0	98.6	....	99.0	98.2
Raw gasoline:						
Per cent charging stock	90.7	90.7	90.7	82.8	82.8	82.8
Finished cracked gasoline:						
Per cent charging stock	....	89.8	89.5	....	82.0	81.4
Analyses of treated products:						
Gravity, deg. A.P.I.	58.8	58.7	59.3	60.1	59.9	59.6
Color, deg. Saybolt	14	24	30+	13	25	30+
Color stability*	....	20	25	....	21	26
Doctor test	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Gum, mg./100 cc. (copper dish):						
Without inhibitor	7	1	1	10	1	0
With 0.01% Universal inhibitor	6	....	....	3	....	....
With 0.025% Universal inhibitor	6	1	1	2	2	1
Sulfur, %	0.02	0.01	0.01	0.03	0.01	0.01
Vapor pressure, Reid—lb./sq. in.	5.6	5.5	....	9.0	8.9	....
Oxygen bomb stability—induction period minutes:						
Without inhibitor	405	240	600	265	275	730
With 0.01% Universal inhibitor	550	....	....	375	....	....
With 0.025% Universal inhibitor	575+	1,000+	1,000+	490	1,000+	1,000+
Octane No.—Motor Method	60	59	59	69	68	67
Tetraethyl lead requirement:						
cc./gal. per 68 octane No.	0.8	0.8	....	....	....	....

*Color deg. Saybolt, after exposure equivalent to two hours noon June sunlight.

the conditions of treatment. The methods applied to the analysis of the lower boiling fractions of crude oils, such as the various modifications of fractionation, would hardly suffice for their determination in cracked gasolines but would have to be supplemented by chemical methods for the separation and identification of the individual hydrocarbons by the preparation of chemical derivatives. Without question, this field is a fertile and fascinating one.

It may be stated briefly that cracked distillates contain the four major groups of hydrocarbons—namely, unsaturated, aromatic, naphthene and paraffin hydrocarbons. The paraffins, with the possible exception of methane, react to some extent with sulfuric acid containing high percentages of sulfur trioxide, the reaction being more pronounced with increasing temperatures. The lower members of the naphthene series react with concentrated sulfuric acid, the reactivity decreasing with increasing molecular weight. Aromatic hydrocarbons dissolve to a considerable extent in sulfuric acid, particularly in concentrations above 80 per cent, the solubility increasing as the concentration of the acid increases. The unsaturated or olefin hydrocarbons are the most reactive group and will therefore be discussed in some detail.

It is generally known that sulfuric acid reacts with olefins to form four types of products, namely, esters, alcohols, polymers and oxidation products. The extent to which each of these reactions occurs is a function not only of the molecular weight, but also of the structure of the olefins and the concentration of the acid. Polymerization increases with the concentration of acid to a maximum with 91 per cent acid. Tertiary alcohols are formed directly by treatment with sulfuric acid and originate from tertiary olefins, which have been shown to be the most reactive. Condensation of olefins with aromatic hydrocarbons has been reported and reduction of olefins by sulfuric acid treatment has been indicated by several workers. There is also some evidence that aromatic hydrocarbons may condense with paraffins when cracked distillates are treated with sulfuric acid.

Polymerization of unsaturated hydrocarbons, in general, may be defined as the union of two or more molecules to form a larger molecule. Condensation reactions involving the union of two or more unlike molecules may for present purposes also be included under the general term "polymerization."

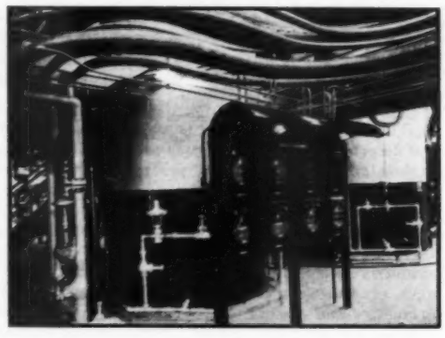
In the sulfuric acid treatment of cracked distillates the losses may be divided into two components, namely, the solution and the polymerization losses. The solution loss is the volume or percentage of distillate which is removed by reaction with the acid and solution in the sludge. The polymerization loss refers to the portion of the gasoline which is converted into higher boiling hydrocarbon fractions.

The polymerization loss may be calculated by the following formula:

$$\frac{A\,[B-(C+D)]}{B}$$

A equals 100 minus the per cent solution loss,
B equals per cent 410° F. endpoint gasoline in untreated cracked distillate,
C equals per cent 410° F. endpoint gasoline in cracked distillate,
D equals per cent distillation loss on distilling treated cracked distillate.

The formula gives the polymerization loss in terms of gasoline content in the untreated cracked distillate and not in terms of the treated cracked distillate.



Outside instrument panel as part of the new Dubbs coking installation at the Shell Oil Company's Wood River, Ill., refinery

The treatment of cracked distillates from Pennsylvania and Mid-Continent stocks with sulfuric acid is rapidly decreasing owing to the introduction of improved methods and more important to the elimination of treating either in whole or in part employing inhibitors for color and gum stability and dyes for color.

For an example of results of treating a cracked California gasoline with varying amounts of acid at room temperature to determine the acid solution losses, polymer losses and sulfur reductions, see Table 6 and Figures A and B which are self-explanatory.

A comparison was made in the treatment of straightrun gasoline from Poza Rica Mexican crude oil and from the cracked gasoline obtained by the cracking of the gas oil obtained from the crude and from the reduced crude. The yield of gasoline in per cent by volume from the gas oil which was cracked was 55 per cent and from the reduced crude 24 per cent. The gasolines were treated with sulfuric acid and sweetened with sodium plumbite with the following results. These data are given for comparative purposes in Table No. 7 and apply only to the particular type of crude under consideration.

TABLE 7—COMPARISON OF GASOLINES

Cracked gasoline from—	Straight-run gasoline	Gas oil	Reduced crude
Treatment:			
Acid, lb./bbl.	1	1	5
Plumbite, deg. Be.	8	8	16
Treating loss, %	0.6	1.0	2.9
Analysis of products:			
Color, deg. Saybolt	30	30	29
Gum, mg./100 cc. (copper dish)	1	2	8
Oxygen bomb stability—induction period, min.	990+	510	790
Sulfur, %	0.05	0.09	0.15
Octane No. (research)	74	76	72

In the treatment of reformed gasolines from Colon crude oil the straightrun gasoline obtained therefrom was reformed at a pressure of 750 pounds per square inch and at a temperature of approximately 1,000° F. and the resulting gasoline was treated.

The treatment used consisted of agitation with 1 and 2 pounds of 93 per cent sulfuric acid per barrel, neutralization with caustic soda and redistillation with fire and steam. No sweetening was required. The results of these tests are summarized in Table 8.

In the desulfurization of cracked gasoline Morrell[1] has shown that split plumbite or caustic treatments, i.e., wherein the oil is treated prior to and after the acid treatment with either caustic or plumbite, has a very marked advantage over the ordinary acid caustic or plumbite treatments.

Morrell, Wirth and Strong[2] have shown that the split plumbite or split caustic method of sulfuric acid treatment, that is, wherein the oil is treated either with plumbite or caustic prior to and following the acid treatment, there are marked advantages in the desulfurization of a blend containing cracked gasoline from an Oregon Basin crude, which is most refractory to treat in this respect, and that the losses and amount of acid

[1]National Petroleum News, Dec. 17, 1930 to Jan. 21, 1931 issues.
[2]The Oil and Gas Journal, 32, 12 (July 20, 1933).

TABLE 9—RESULTS OF TREATING CRACKED GASOLINE FROM OREGON BASIN CRUDE

Treatment—	Original	Simple acid-caustic		Split plumbite			Split caustic	Split plumbite 0-30% fraction 2 lbs., 30-100% fraction 10.5 lbs.	Split plumbite 0-40% fraction 3 lbs., 40-100% fraction 11 lbs.	Split plumbite 0-50% fraction 4 lbs., 50-100% fraction 12 lbs.
Acid, lbs. per barrel	None	8	8	10	12	14	12	8	8	8
Concentration, per cent	....	93	93	93	93	93	93	93	93	93
Solution loss, per cent	....	2.6	3.9	2.9	3.4	3.9	3.4	2.7	2.9	3.3
Polymerization loss, per cent	....	0.7	0.9	0.7	1.3	1.8	1.3	0.7	0.8	0.9
Gravity, deg. A.P.I.	57.9	57.2	57.1	56.2	56.3	56.3	55.7	56.9	56.7	56.6
Endpoint, deg. F.	401	396	398	390	390	390	392	390	391	390
Color, deg. Saybolt	Red	26	29	27	30+	30+	26	30+	30+	30+
Color stability*	....	25	26	25	30	29	25	30	29	29
Sulfur, per cent	0.43	0.22	0.20	0.16	0.13	0.12	0.14	0.15	0.17	0.17

*Equivalent to two hours' noon June sunlight.

TABLE 10—TREATMENT OF CALIFORNIA CRACKED NAPHTHA AT VARIOUS TEMPERATURES TO PRODUCE GASOLINE OF U.S.M.G. BOILING POINTS CONTAINING 0.15 PER CENT SULFUR

Gravity of naphtha ..... 53.7° A.P.I.
Per cent sulfur 0.71
Per cent gasoline (U.S.M.G.) 93.0

Maximum temperature of treatment—	5° F.	20° F.	30° F.	45° F.	60° F.	100° F.	166° F.*
Lbs. of 98 per cent acid per gal. of naphtha	0.60	0.51	0.69	0.63	0.84	1.15	1.50
Per cent sulfur in treated naphtha	0.27	0.38	0.36	0.49	0.58	0.74	0.79
Per cent gasoline in treated naphtha	88.7	90.5	86.6	84.1	79.8	74.0	62.2
Polymerization loss†	4.6	2.7	6.9	9.6	14.2	20.5	23.1
Acid-treating yield	92.7	92.7	92.8	91.8	90.2	88.3	78.9
Rerun yield	88.7	90.5	86.6	84.1	79.8	74.0	62.2
Net gasoline yield from cracked naphtha	82.3	83 9	80.3	77.2	72.0	65.3	49.1

*Normal treatment—acid added at atmospheric temperature. †Per cent of original crude gasoline content lost by polymerization.

required are less than when the simple acid treatment is used; also that the separate treatment of individual fractions of the cracked distillate shows improved results in respect to desulfurization when compared with the treatment of the entire distillate. This is summed up in Table 9.

Low Temperature Treatment of Cracked Distillate

Notable among the methods proposed for the treatment of cracked distillates with sulfuric acid primarily for the purpose of desulfurization and reducing polymerization and solution losses is the low temperature treatment described by Halloran[1]. This process comprises washing the cracked distillate with caustic soda, subjecting the distillate to drying treatment with acid sludge, cooling the distillate to approximately —5° F. in a multistage cooling system during the treatment with the fresh sulfuric acid, separating and recirculating the sludge and finally washing and neutralizing the treated distillate. Low temperature treatment of cracked distillates primarily serves the purpose of effecting partial desulfurization with a substantial reduction of the usual large losses by reaction solution and polymerization. In some cases the desulfurization of the distillate is more marked than with treatment at normal temperatures but in some cases desulfurization has not been improved by the low temperature treatment. This process has recently been combined with the Stratford process which involves a continuous treatment with sulfuric acid by quickly contacting the acid with the oil and separating by centrifuging the acid sludge in minimum time.

Halloran,[2] in Table 10, shows the following results in the treatment of a California cracked naphtha at various temperatures from 5° F. to 166° F. (the acid being added at atmospheric temperature in the latter case).

A flow diagram of the process is shown in Figure 1.

[1]The Oil and Gas Journal, 26, No. 29, p. 36 (1927).
[2]World Petroleum Congress, 2, p. 3 (1933).

Halloran points out that this process is a major advance in the art of refining cracked gasolines which contain the more stable types of sulfur compounds and that another important application of the process is the refinement of gasolines containing large amounts of gum-forming constituents such as those produced by vapor phase cracking, and particularly where these gasolines are also characterized by a high sulfur content.

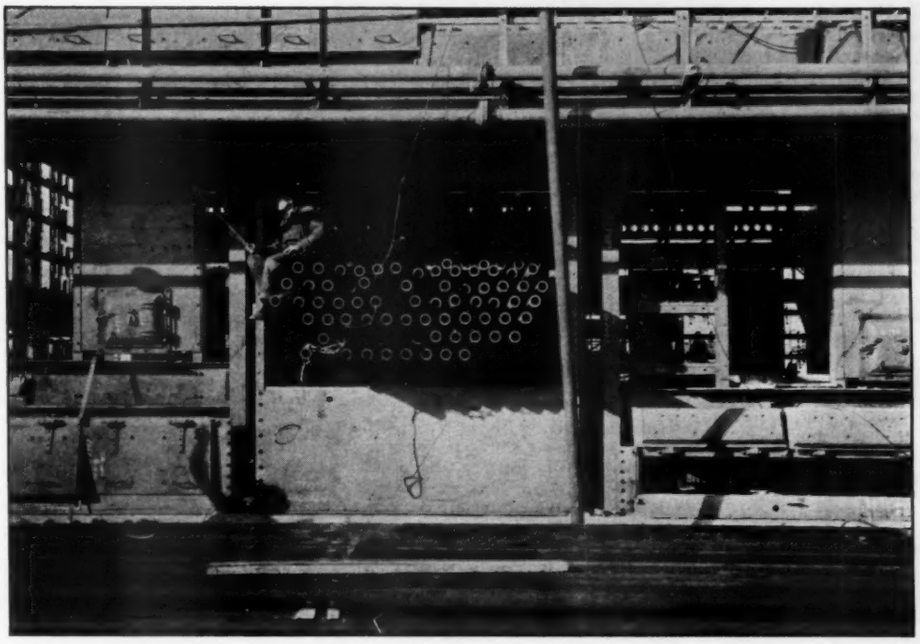
In summing up the advantages of the low temperature treating process as the result of and especially in the commercial operation of a plant operating at 0 to 10° F., Halloran[1] comes to the following conclusions in comparison with ordinary acid treatment.

1. The amount of acid required is less in cold treatment because it acts partly as a solvent for sulfur compounds;
2. Polymerization losses are lower;
3. There is a higher yield due to reduction in polymerization losses;
4. Retention of antiknock constituents:
5. There is less emulsion trouble in the water and caustic washes following the acid treatment;
6. There are decreased caustic requirements in rerunning treated distillates;
7. The acid sludge is more easily regenerated;
8. The cold treated stocks are more easily sweetened since mercaptans have been removed by the solvent action of the acid at low temperatures;
9. There is always less gum in cold treated stocks due to less oxidation in the acid treatment;
10. The gasoline has improved color stability.

The article contains a table showing the savings in cold treating compared to normal treatment.

Table 11 shows the results of laboratory treatment of a cracked gasoline from a California crude oil employing constant amounts of acid and at a temperature varying from 0-100° F.

Cooke and Hayford[1] have described the Stratford process in the treatment of a cracked West Texas pressure distillate containing 0.4 to 0.5 per cent sulfur comprising quick contact and centrifugal separation acid treatment process with counterflow treatment in three stages. The contact time in each mixer was less than one second and the total time before complete separation about three seconds. The data indicate that 13.6 pounds of 98 per cent sulfuric acid was used per barrel and that there was a polymerization loss of 3.55 per cent in reducing the sulfur to 0.1 per cent. This did not, however, include the low temperature feature of the present Stratford process.



New Foster Wheeler heater being built in the Houston refinery of the Shell Petroleum Corp. to reform 10,000 barrels of straightrun distillates from the crude units daily

The combination process is shown in Figure 2, which has been simplified for purposes of illustration. It comprises a counterflow system wherein the raw distillate is passed through a cooler in heat exchange with the treated distillate. After

[1]Nat'l. Pet. News, 25, No. 30, 35 (1933).

TABLE 11—TREATMENT OF CRACKED DISTILLATES WITH 98 PER CENT SULFURIC ACID AT VARYING TEMPERATURES

Type of cracked distillate—	Temp.	Lbs./	Per cent solution	Per cent	Per cent sulfur in finished
Californian D (0.59% S., 86.7% 410° F., E.P.) ...	°F.	bbl.	loss	polymers	gasoline
	100	30	8.1	9.7	0.13
	70	30	7.7	6.8	0.11
	40	30	7.0	4.9	0.08
	18	30	7.5	1.7	0.08
	0	30	7.2	1.6	0.07

[1]World Petroleum, 5, No. 4, 123-8 (1934).

TABLE 12—EFFECT OF TEMPERATURE ON THE TREATMENT OF CRACKED GASOLINE FROM CALIFORNIA CRUDE OIL

Temperature, °F.			70					40					18					0				
Treatment	None		Split caustic				Simple acid	Split caustic				Simple acid	Split caustic				Simple acid	Split caustic				Simple acid
Quantity of acid, lbs.	...	...	5	10	20	30	10	5	10	20	30	10	5	10	20	30	10	5	10	20	30	10
Concentration, per cent	...	...	93	93	98	93	93	93	93	98	93	93	93	93	98	93	93	93	93	98	93	93
Losses, per cent																						
Solution	...	...	1.6	3.8	7.8	14.5	3.8	1.6	2.9	6.5	10.6	2.9	1.3	2.9	5.2	7.3	2 9	1.4	2.0	4.5	6 0	2.1
Polymerization	...	...	1.5	3.3	8.0	8.9	3 2	1.4	2.3	6.3	8 1	2.3	1.0	1.8	3.2	3.9	1.8	1.0	2.4	3.2	4.5	3.3
Distillation	...	...	1.2	1.0	0.8	0.6	1.0	0.8	0.8	0.8	0.8	0.8	1.0	0.9	0.9	0.8	0 8	0.8	0.7	0.8	0.7	0.8
Total	...	...	4.3	8.1	16.6	24.0	8.0	3.8	6.0	13.6	19.5	6.0	3.3	5.6	9.3	12.0	5.5	3.2	5.1	8.5	11.2	5.2
Gravity, °A.P.I. at 60°F.	...	59.2	59.8	59.9	58.0	58 5	60.1	60.4	60.3	59.8	59.5	60 3										
Color	Red	Yel.	28	30	28	28	30	24	30+	30+	28	30+	60.7	61.0	60.0	60.0	60.2	60.4	60.3	60.1	59 9	60.3
Color stability*	...	...	23	25	24	23	25	19	25	26	23	25	27	30+	30+	30+	30+	23	28	30+	30+	27
Gums, copper dish, Mg./100 cc.:													22	25	26	26	24	18	24	26	26	22
Original gasoline	42	52	2	2	4	3	1	3	1	1	6	1	2	2	3	1	2	5	2	2	3	3
Original gasoline + 0.25% inhibitor	...	33	3	5	2	2	1	2	1	6	7	3	2	2	3	2	1	1	1	1	2	2
Sulfur, per cent	.61	.61	.30	.18	.17	.13	.24	.40	.23	.13	.11	.29	.40	.32	.13	.11	.33	.38	.32	.17	.14	.34
Reid vapor pressure, lbs.	9.0	7.4	Below 5.0																			
Octane No., motor method	71	70	71	71	69	69	70	70	71	70	69	70	71	71	70	70	70	70	70	70	70	70
Oxygen bomb stability, induction period, min.:																						
Original gasoline	300	145	120	145	225	150	3,840	120	220	230	310	740	165	250	360	270	315	125	190	230	290	150
Original gasoline + .025% inhibitor	...	175	390	1,165	2,300†	2,100	3,840	280	895	2,330	2,400†	1,460	360	640	1,320	1,300	740	300	535	995	1,120	500
Doctor	...	...	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Per cent plumbite used	...	3	3	3	Sweet	3	3	3	Sweet	3			3	3	3	Sweet	3	3	3	3	Sweet	3
Concentration, °Be.	...	30	8	8	off still	8	8	8	off still	8			16	16	8	off still	16	16	16	8	off still	16
100 cc. A.S.T.M. Distillations																						
I.B.P., °F.	...	100	112	109	124	122	113	110	110	118	126	108	107	107	113	120	108	108	105	112	115	112
50 per cent	...	236	237	240	254	254	248	235	236	247	250	240	234	233	242	240	237	236	236	240	241	236
90 per cent	...	355	316	310	340	338	324	314	314	332	330	326	316	312	322	320	326	320	319	324	324	324
E.P., °F.	...	401	380	380	385	386	384	380	380	390	392	386	380	380	386	384	384	380	382	386	387	382

*Equivalent to two hours noon June sunlight. †Cut.

being chilled the distillate is passed into a contactor wherein it is contacted with the sludge from the final distillate and is then passed in counterflow through a series of three chillers, contactors and separators, being treated with the fresh acid in the third stage, with a mixture of fresh acid and sludge in the second stage, and with sludge acid in the first stage, and finally being neutralized with caustic soda. This process has very marked advantages where it is necessary to effect desulfurization of the distillate.

The results in Table 12 show the treatment of California cracked gasoline with sulfuric acid at temperatures varying from 0 to 70° F.

The following conclusions may be drawn from the results shown in Table 12:

1. Reduced temperature did not increase sulfur reduction using 93 per cent sulfuric acid, split caustic, or simple acid treatment.

2. With 98 per cent acid and split caustic sulfur reduction was slightly increased with decreased temperature.

3. Sulfur reduction was increased by increase of amount of acid at each temperature.

4. Loss in octane number was slightly less at reduced temperature.

5. With split caustic and 93 per cent acid, the induction period increased with increase of acid at all temperatures; the greatest increase was at 18° F.

6. The induction period was reduced much more by split caustic than by simple acid.

7. With simple acid treatment, the induction period was decreased with decreasing temperature. The inhibitor susceptibility was increased.

8. Solution and polymerization losses (a) increased with increasing quantities of acid at all temperatures; (b) decreased with decreasing temperature with any quantity of acid; (c) were the same with either simple acid or split caustic at all temperatures.

From a large number of experiments by Morrell and Egloff[1] it has been shown that while the extent of polymerization and solution is very greatly reduced by reduction in temperature, the sulfur content of the treated oil may show very little change. This is indicated in Table 13.

TABLE 13—TREATMENT OF CALIFORNIA CRACKED DISTILLATE AT VARYING TEMPERATURES

Acid conc. per cent	Lbs./bbl.	Temp., °F.	Soln. loss	Polymers	Per cent sulfur in finished gasoline
93.24	30	100	7.2	6.3	0.15
93.24	30	70	5.6	5.3	0.14
93.24	30	40	5.4	3.6	0.15
98	22	100	6.2	6.3	0.14
98	22	70	5.4	5.2	0.14
98	22	40	5.4	3.3	0.14
98	22	0	5.9	1.6	0.12

Similar results have been shown with Venezuelan and other cracked distillates. However, that a marked change may take place even in sulfur content is shown by the following results:

TABLE 14—TREATMENT OF CRACKED DISTILLATES WITH 98 PER CENT SULFURIC ACID AT VARYING TEMPERATURES

Type of cracked distillate—	Temp., °F.	Lbs./bbl.	Per cent solution loss	Per cent polymers	Per cent sulfur in finished gasoline
Calif. dist.: (8.6.59%; 410° e.p., 86.7%)	100	30	8.1	9.7	0.13
	70	30	7.7	6.8	0.11
	40	30	7.0	4.9	0.08
	18	30	7.5	1.7	0.08
	0	30	7.2	1.6	0.07

[1]It may be generally concluded that polymerization is apparently a function of temperature and that the lower the temperature the less the polymerization. The solution loss apparently is not as directly dependent on the temperature as polymerization.

[2]World Pet. Conf., London, July 24, 1933.

TABLE 15—CALIFORNIA CRACKED GASOLINES

	Untreated	Acid treated		30% Overhead untreated acid treatment of bottoms	
GASOLINE A—					
Acid, lbs./bbl. bottoms	....	....	....	4	6
Acids, lb./bbl. raw gasoline	none	....	6	2.8	4.2
Sulfur in overhead, frac. %	0.19	....	....	....	....
Gravity, °A.P.I.	57.2	....	56.4	57.7	57.6
Color, °Saybolt	....	....	20	20	25
Color stability*	....	....	19	18	22
Gum, Mgs./100 cc. copper dish	....	....	22	43	17
Sulfur, % in total blend	0.32	....	0.22	0.26	0.19
GASOLINE B—					
Acid, lbs./bbl. bottoms	....	....	....	8	16
Acid, lbs./bbl. raw gasoline	None	8	16	5.6	11.2
Sulfur in overhead, fraction per cent	0.19	....	....	....	....
Gravity, °A.P.I.	55.1	56.1	56.1	56.4	56.6
Color °Saybolt	....	27	30+	30+	27
Color stability*	....	24	29	27	27
Gum, mgs./100 cc. copper dish	....	35	60	169	178
Sulfur, per cent in total blend	0.62	0.43	0.25	0.40	0.24
GASOLINE C—					
Acid, lbs./bbl. bottoms	....	....	....	10	20
Acid, lbs./bbl. raw gasoline	None	10	20	7.0	14.0
Sulfur in overhead, fraction per cent	0.35	....	....	....	....
Gravity °A.P.I.	49.8	51.4	50.8	51.5	51.5
Color °Saybolt	....	30+	27	30	28
Color stability*	....	30+	24	27	27
Gum, mgs./100 cc. copper dish	....	29	6	34	6
Sulfur, per cent in total blend	0.67	0.36	0.22	0.35	0.28

*Equivalent to two hours noon June sunlight.

One of the most important principles in the development of treating, both from the viewpoint of economy and improved results in the use of sulfuric acid and other reagents, has been the removal of a relatively light overhead fraction requiring practically no treatment or a very mild treatment only, with acid or some other more drastic treatment of the bottoms or side cut from the fractionating column, and combining the distillate from the acid treated material with the relatively untreated fraction.

This process and improvements thereon are disclosed by Morrell[1]. This process is widely used, the savings being dependent upon the amount of overhead distillate which can be removed with little or no treatment and the percentage of side cuts or bottom cuts which are treated according to requirements. For example, with a distillate obtained in the cracking of a West Texas charging stock over 40 per cent of the gasoline fraction was removed and required only an alkaline wash using soda ash or caustic soda. The side cut was acid treated, neutralized and redistilled. An overhead product of better than 28 color was obtained by this treatment, with a saving of over 50 per cent in acid consumption. In the case of Mid-Continent and Pennsylvania charging stocks from 50 to 70 per cent and more may be taken overhead, requiring no additional treatment besides alkali or water-wash, and in some cases the addition of an inhibitor. The amount which may be taken overhead depends upon the color requirement. Where the gasoline is dyed and an inhibitor added considerably larger amounts may be removed with only a very light treatment such as alkali and/or water-wash.

The results of partial treatment of California cracked gasoline are shown in Table 15.

Each of the gasolines was treated by agitating them with from 6 to 20 pounds of acid per barrel of distilling with fire and steam at a maximum temperature of 350° F. The results show that improved desulphurization is obtained for each of the three cracked distillates by the removal of approximately 30 per cent untreated fraction and acid treatment of only the heavier (70 per cent) fraction or bottoms. The gasoline from Sample A, with an original sulfur content of 0.32 per cent, showed a reduction to 0.22 when treated with 6 pounds of 23 per cent sulfuric acid. The 30 per cent overhead fraction contained 0.19 per cent sulfur. Acid treatment of the bottoms with 4 and 6 pounds of acid, respectively, and redistillation of the acid treated product with subsequent blending of the overhead untreated distillate and the distillate from the treated bottoms showed sulfur contents of 0.26 and 0.19 per cent, respectively. The quantities of acid used per barrel calculated back to the original gasoline are 2.8 and 4.2 pounds. Thus, a better desulfurization is obtained upon the total gasoline with 4.2 pounds of acid (treating the bottoms and blending the distillate therefrom with the untreated overhead) than with 6 pounds upon the original gasoline, and the color and color stability are also improved. Similar results are shown with the other two gasolines B and C. For example, in the case of gasoline B equivalent desulfurization was obtained with 11.2 pounds of acid per barrel by treating the bottoms and blending the distillate therefrom with the 30 per cent untreated overhead as by the treatment of the total gasoline with 16 pounds of acid. In the case of C, however, the sulfur content of the untreated overhead fraction is 0.35 per cent, so that no saving in acid may be shown when the sulfur content of the final blend is brought to a point below this value.

In another series of tests 14.7 A.P.I. gravity charging stock from Naranjos crude oil was cracked yielding 36.3 per cent of gasoline and 60.3 per cent of fuel oil residuum. This gasoline was subjected to sulfuric acid treatment using the split plumbite method with the following results. Employing 30 pounds of 93 per cent acid per barrel upon the whole 400 endpoint gasoline and 30 pounds per barrel after removing 30 per cent which was untreated with the exception of a simple wash. The advantages of distilling off a portion of the gasoline without treatment are clearly demonstrated by the results shown in Table 16.

TABLE 16—CRACKED GASOLINE FROM NARANJOS CRUDE

Type of gasoline produced	400° F. endpoint	
Treatment	Split plumbite	
	93% acid	30% overhead untreated, 70% bottoms 30 lbs./bbl acid
Acid, lbs./bbl.	30	21
Treating losses:		
Acid solution loss, %	7.2	4.9
Polymerization loss, %	6.2	4.4
Distillation loss, %	1.2	1.5
Total loss, %	14.7	10.8
Estimated total loss for 10 lbs. vapor pressure, %	14.2	10.1
Yields:		
Finished cracked gasoline, % raw gasoline	85.8	89.9
Raw gasoline, % charging stock	36.3	36.3
Finished cracked gasoline, % charging stock	31.1	32.6
Analysis of treated products:		
Gravity, °A.P.I.	55.9	60.1
Color °Saybolt	27	30
Color stability*	27	25
Doctor test	Neg.	Neg.
Gum, Mgs./100 cc. (copper dish)		
Without inhibitor	8	3
With inhibitor (0.025%)	4	2
Sulfur, %	0.14	0.12
Oxygen bomb stab.—induction period, min.:		
Without inhibitor	170	50
With inhibitor (0.025%)	660	615
Octane number:		
Research method	63	65
Motor method	58	59

*Equivalent to two hours noon June sunlight.

[1]U. S. Patents Nos. 1,827,537 and 2,009,118.

TABLE 17—RESULTS OF TREATING CRACKED GASOLINE FROM SANTA FE CRUDE

Treatment	None	Sweetened	Split caustic		
Acid, lbs./bbl.	None	None	4	7	10
Finished cracked gasoline—% raw gasoline	....	....	98.6	97.2	95.9
Analyses of treated products:					
Gravity, °A.P.I.	58.8	....	61.1	61.1	61.1
Color °Saybolt	Red	Red	22	25	29
Color stability*	....	....	18	19	21
Doctor test	Pos.	Neg.	Neg.	Neg.	Neg.
Gum mgs./100 cc. (copper dish):					
Without inhibitor	196	167	7	8	4
With .25% Universal inhibitor	199	180	7	.	7
Sulfur, %	0.63	0.62	0.40	0.37	0.29
Oxygen bomb stab., induction period, minutes:					
Without inhibitor	440	175	85	85	125
With 0.025% Universal inhibitor	490	240	230	260	420
Octane No.—motor	72	...	71	70	...

*Color °Saybolt after exposure equivalent to two hours noon June sunlight.

NOTE: To be continued next week.

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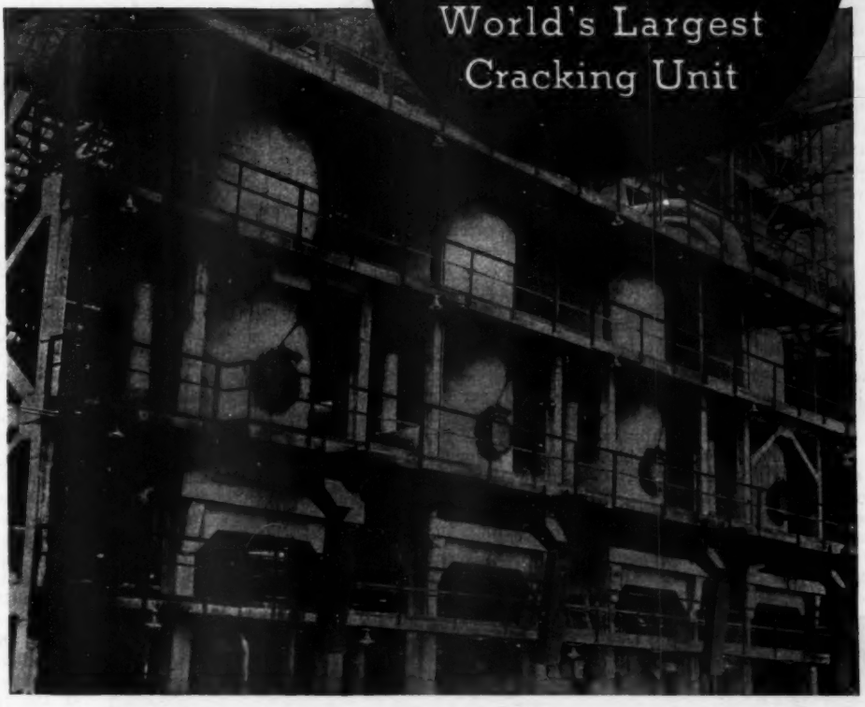

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The Laboratory Engine Testing of Motor Lubricants

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In an article[1] presented at the 1936 annual S.A.E. meeting in Detroit, and reprinted in the February 13, 1936, The Oil and Gas Journal, cylinder wear and ring sticking, as determined in automotive, bus and aircraft engines, were discussed by Messrs. Larson, Ainsley, and the writer. A laboratory engine test method in which tests are made, using a liquid-cooled engine at high-jacket temperatures, was mentioned in that article. For the sake of brevity, no details of the test method were given at that time. It is intended in this paper to show the reasons for and advantages of making such tests at high operating temperatures, which show at one time oil oxidation, and the effect of the oxidation products with respect to ring sticking, and alloy bearing corrosion.

In a previous paper[2], a laboratory lubricating oil test unit was described, which was developed specifically to duplicate the depreciation of oils in the water-cooled engines of the average car. A sufficiently large amount of oil is used in this unit so that complete analysis of the oxidized oil may be obtained for comparison with used oils from test cars and engines. Correlative tests made at that time to a total of 201,900 miles gave reasonably good indications that motor oils become unsuitable for hard service at about the time their tar content reaches 1 per cent. Also, in the laboratory oxidizer test unit and in laboratory test engines, it was shown that 1 per cent tar content coincided with the end of the significant induction period of the oil with respect to tar formation and, after that point, tar formation became very rapid in practically all oils. Therefore, the laboratory oxidizer test results were reported as the induction period in hours required to reach this tar content. It is gratifying to note from a paper also presented at the annual S.A.E. meeting in Detroit, in January, 1936, by F. L. Faulkner, of the Armour company, that as a result of commercial scale fleet tests he confirms this figure of 1 per cent tar content as the endpoint for satisfactory automotive service. The laboratory oxidation test unit gives a fair measure of the relative sludge forming tendencies of different oils, but cannot measure the relative potential ring sticking tendencies of the oxidation products from different oils. It is indicated that the oxidation products from different base stocks differ considerably in potential ring sticking capacity. Normal water-cooled engines in normal mechanical condition with satisfactory cylinder surface and blowby conditions rarely stick piston rings. Rings and grooves may become filled with tarry deposits so that their oil draining capacity is reduced, but in most of such engines temperatures are sufficiently low that these deposits do not carbonize and cement the rings in their grooves.

From knowledge of the oxidation characteristics of motor oils, it was indicated that mild laboratory engine tests for reasonably short periods could fail to differentiate a series of oils of varying stability, simply because none of the oils would be oxidized to or past the end of their induction periods. In such circumstances results could be considerably confused because the experimental error of the analysis and interfering factors, such as carbon from blowby, and ash, would cover the small range of analysis for insolubles on the used oils. If tests could be made sufficiently long or severe to carry all but the most stable oils beyond the end of their induction periods, differences of considerable magnitude could be produced and a series of oils allocated in their proper order of overall value. Further, under conditions of amplified severity, depreciation of oil would then be so great that definite effect of the tar, produced by the severe oxidation, on ring sticking would be noted if ring and cylinder surface temperatures were high enough to permit it.

Engine tests made at 180° F. jacket temperature showed that fresh oils could be run over very long periods until from 5 to 8 per cent tar was formed, without causing stuck rings. An oil oxidized artificially to 5 per cent tar content, thus having already been oxidized beyond the end of its induction period, rose to 10 per cent tar in a 50-hour test at 180° F. jacket temperature, and caused very heavy deposits on tappet clusters and other surfaces and some deposits on top of intake valve guides. Piston rings were heavily clogged with gummy tar deposits, but no rings were stuck.

It seemed obvious, therefore, that to run engine tests that would show definite relative sludging tendencies in a reasonably short time, and to observe the ring sticking characteristics of oils, jacket temperatures would have to be raised considerably. A series of experimental tests indicated that different jacket temperatures were suitable for different engines, depending on cylinder and ring conditions and rate of blowby. For engines normal in these respects, a jacket temperature of 250° F. appears to be most generally satisfactory, and attempts to accelerate the tests by the use of higher temperatures (in the neighborhood of 300° F.) appear to produce erratic results. For engines having exceptionally low blowby rates, such high temperatures may, however, be necessary. Severity of conditions may thus be raised to those existing in air-cooled engines, but the temperature conditions can be more closely controlled.

Description of Engine Test Set-Up and Test Procedure

The engine test set-up is shown on Figure 1. The engine is a four-cylinder Waukesha type ZA unit, on which a compression ratio of 5:1 is used. The use of this compression ratio is to avoid detonation with 70 octane fuels, which occurs readily when using high jacket temperatures. The use of four cylinders is considered desirable, in that piston ring conditions at the end of a test vary slightly with respect to each other, and the presence of four cylinders gives a fairly good average result. Ethylene Glycol is used as the cooling medium, and a special cooling system has been arranged to maintain the test temperature constant. It is shown diagrammatically in Figure 2. A multitube heat exchanger is used as a cooler, mounted vertically. The cooling fluid from the engine enters at the top of the exchanger and passes downward through the tubes, a centrifugal pump at its base taking suction and delivering back to the engine. The heat exchanger is supplied with water, which is allowed to boil, and the evaporation balanced by a water feed to hold a constant level. The circulation is rapid, the cooling fluid entering the engine at from 242° F. to 245° F. and leaving at 250° F. By the use of rapid circulation and a small temperature rise through the engine, the formation of vapor pockets and local overheating is avoided.

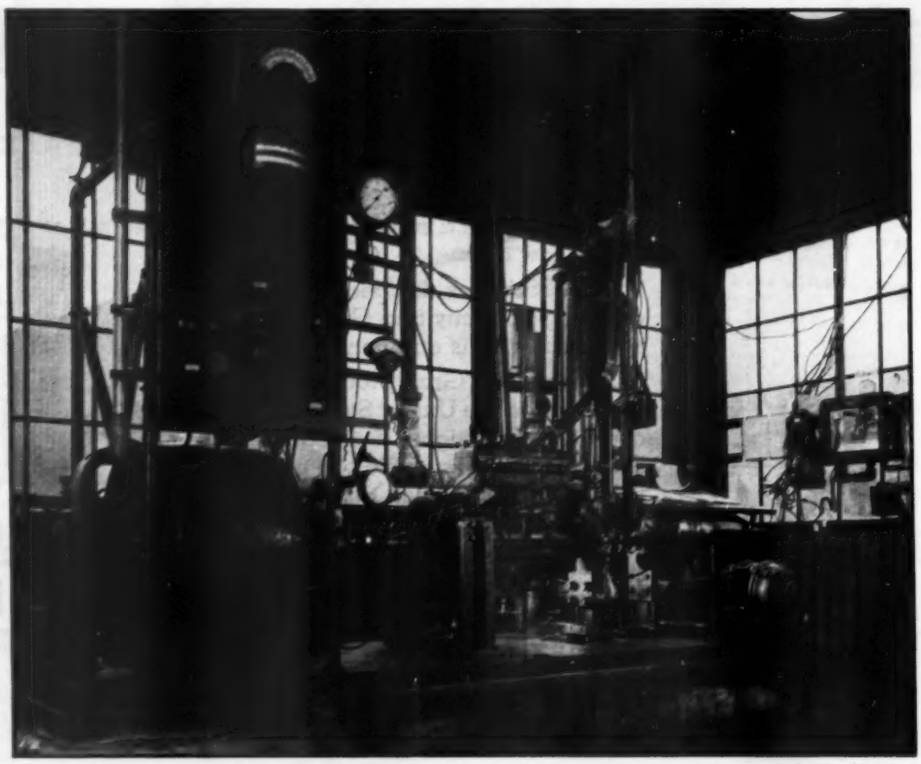

Fig. 1—Four-cylinder Waukesha motor and dynamometers as part of equipment in development laboratory as used to study ring sticking tendencies of motor oils

The engine is normally run for 50 hours at 1,000 r.p.m. at 75 per cent output, taking samples at 16, 32, and 50 hours for analysis. Tests obtained on the intermediate samples are viscosity/210, carbon residue, 86° naphtha insoluble, chloro-

form soluble and insoluble, and ash. In addition, complete laboratory tests are obtained on the drainings. One gallon of oil is charged to the engine at the start. One hundred c.c. samples are taken at the intervals noted. Oil charged, samples taken, and replenishment are recorded by weight. If the oil consumption characteristic permits, it is desirable in running engine tests to avoid making oil replenishment to the crankcase during a test. This is usually impossible, and replenishment is made in these engines at the 16 and 32-hour points, after the samples have been taken for analysis. Over any series of tests on similar viscosity oils, the oil consumption rate changes very little, provided that very wide differences in ring sticking are not found, so that the oil consumption factor has not great significance. Because of the high temperatures used, dilution is not appreciable, and viscosity rises from the start of the test. Reduction in viscosity and changes in other factors immediately after replenishment does not upset the data, because of the time which elapses before the next sample is taken. In assembling the engine, care is taken to prevent oil leakage and also to prevent variations in consumption and blowby which might be caused by varying cylinder distortion. A hydraulic wrench is used for tightening head bolts and all cylinder head studs are tightened to 150 pounds pressure, as indicated by the gauge on the wrench.

Periodic readings of the temperature of the body of the oil in the crankcase are taken and, in addition, temperatures are obtained of the oil pump discharge, cooling fluid to and from the engine, blowby vapor as measured at the breather outlet, and the intake air and exhaust gas. Until recently, crankcase temperature was maintained at 220° F., which was very close to the natural temperature most oils attain under these conditions in this engine.

A typical run sheet is shown on Table 2 which covers the run at 320° F. crankcase temperature shown on Table 3. Temperatures are recorded at 15-minute intervals but are shown at four-hour intervals on the table.

Experience enables operators to determine in many cases the approximate point at which ring sticking sets in, from slight increase in requirement of water by the cooling system, and by the more obvious factors of increase in blowby rate and temperature, slight to serious loss in power, and increase in fuel and oil consumption. In occasional cases of very serious ring sticking, cylinder bores and pistons may be appreciably scuffed or scored. In such cases the effect may be concentrated on one cylinder. If not too serious, tests may be continued for a time but will continue to be measurably worse on that particular cylinder. The presence of four cylinders in such cases has the advantage that results may be averaged from the three mechanically satisfactory cylinders for some time before overhaul becomes necessary, if the faulty cylinder is only slightly affected.

Evaluation of Results

The conditions of test previously described are such that unstable oils depreciate considerably beyond the end of their induction periods. Table 1 shows the changes in a series of five basic oils that occur in this engine test and the results on ring sticking that accompany these changes. A quantitative method of expressing such changes has been applied[2] and the results are also shown on the table. There is a striking difference in tar development between oil 1 and oils 2 and 3, and from oils 2 and 3 to oil 4 and to oil 5. However, the difference in ring sticking property is not nearly as great as that indicated by the relative tar contents. Oil 5 formed about 10 times as much tar as oil 1, yet the number of rings stuck and deposits in piston ring grooves were only about twice as great. This suggests that it is not only the quantity but also the character or potency of the tarry products of oxidation with respect to ring sticking that is important. In this particular series of tests the carbon residue of the used oils appears to give an approximate indication of the relative number of rings stuck. While it is not intended to convey that the carbon residue of the used oil is a reliable indication of the potential ring sticking property of an oil, nevertheless, the carbonization of oils in the carbon residue test in some measure resembles the process occurring while piston rings stick in their grooves. Extensive work may enable some correlation to be established.

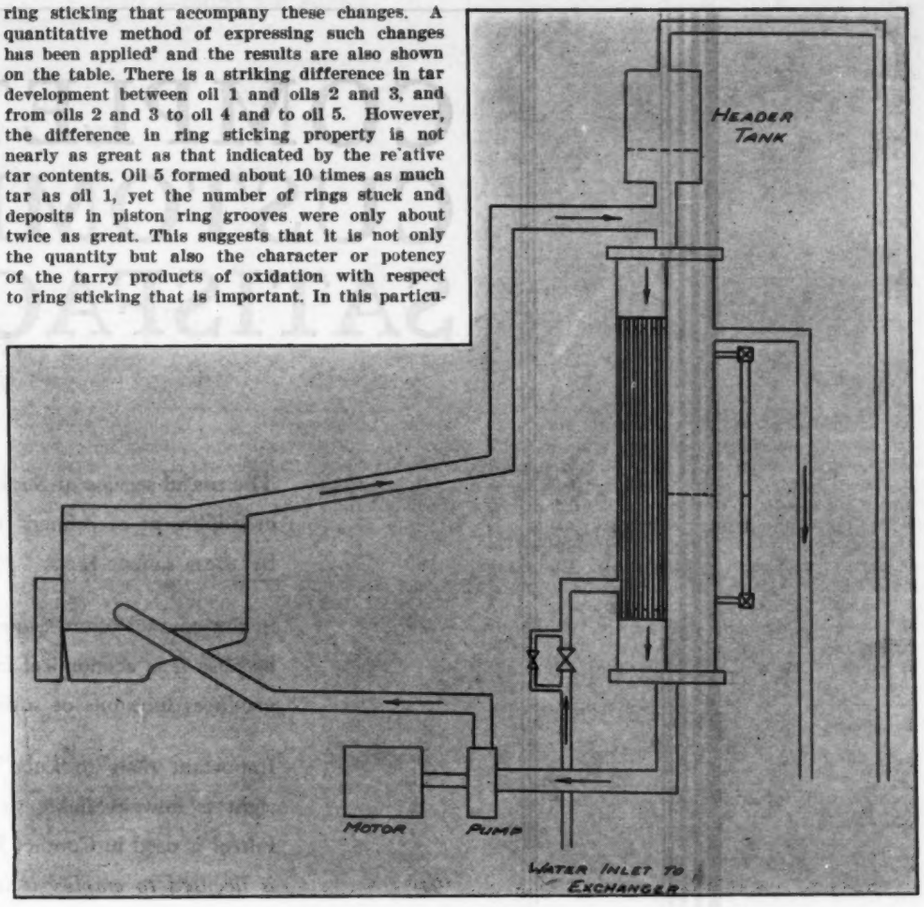

Fig. 2—Diagram of cooling system used on Waukesha test engine

Test Modified to Measure Corrosion to Alloy Bearings

When it was found desirable to study corrosiveness of oils to alloy bearings, it seemed desirable to change the conditions of the test to make it critical in this respect. As corrosion to Cadmium-silver and copper-lead becomes much more severe as the crankcase temperature rises, and particularly when it exceeds 300° F., it did not seem difficult to increase the crankcase temperature beyond this point to measure corrosiveness. This engine is normally equipped with babbitt bearings, and is allowed to remain so as far as the main bearings are concerned. Thus, where corrosive oils are tested, the long time and trouble required to replace main bearings is avoided. One connecting rod is equipped with Cadmium-silver alloy shells and one with copper-lead shells. It so happens that Cadmium-silver connecting rod bearing shells for a popular car fit this engine and they may be obtained conveniently and cheaply. The copper-lead bearings are specially made for the purpose. The crankcase was jacketed, and highly heated air is blown through the jacket to raise the oil temperature from its normal 220° F. to 320° F., where it is maintained throughout the test runs.

Results indicate good agreement with laboratory bearing corrosion tests which have been devised by other investigators[3] to correlate with road tests on cars which suffer from corrosion of alloy bearings under extreme conditions of operation.

TABLE 1—250° F. JACKET TEMPERATURE ENGINE TESTS ON 5 BASIC OILS OF VARYING STABILITY—TEST AT 220° F. CRANKCASE TEMPERATURE

	1 Highly solvent treated Penna. S.A.E. 30		2 Mildly solvent treated Penna. S.A.E. 30		3 Conventional non-solvent treated Penna. S.A.E. 30		4 Acid treated Mid-Continent S.A.E. 30		5 Regular Gulf Coast S.A.E. 40	
Oil—	New	Used	New	Used	New	Used	New	Used	New	Used
Vis. at 100° F.	398	696	444	760	445	757	523	842	1244	2904
Vis. at 210° F.	61	79.5	61	81.3	61	82.4	61	77.0	71	124
Neutralization No.	.015	1.281	.015	1.54	.015	1.49	.015	1.21	.015	1.928
Conradson Carbon	.299	1.664	.350	1.530	.377	2.018	.340	2.067	.049	2.230
% Tar, 66° N. Insoluble	...	.202	...	.344	...	.381	...	1.354	....	2.000
Choloform Soluble	...	...	...	.309	...	.328	...	1.291	....	1.820
$CHCl_3$ Insol. (Diff. of above)	...	...	...	.035	...	.053	...	.063	...	.180
Ind. Sludging Time (hrs.) (4)	375	...	135	...	90	...	25	...	16	....
Sinclair Oxidizer (2)										
Induction period (hrs.)	300	...	210	...	150	...	81	...	68	....
Vis. rise at 100° F.	300		316		312		309		1660	
Vis. rise at 210° F.	18.5		20.3		21.4		16 0		53.0	
Neut. number rise	1.266		1.535		1.474		1.195		1 923	
Carbon rise	1.365		1.180		1.642		1.727		2.181	
WORK FACTOR:										
Vis. at 210° F. (C = 1.3)	.606		.567		.543		.659		0.030	
Con. Carbon (FRP = 3.0)	.494		.555		.373		.350		.261	
Acid number (FRP = 4.0)	682		.617		.630		.700		518	
Tar (FRP = 2.0)	.899		.828		.810		.323		.000	
Average work factor	.670		.642		.589		.508		.202	
Piston ring condition after test	1 ring stuck per piston Total 4		1 ring stuck per piston Total 4		Av. 1.5 rings stuck per piston Total 6		Av. 2 rings stuck per piston Total 9		Av. 2.5 rings stuck per piston Total 10	

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TABLE 2—ENGINE TEST NUMBER

Conditions: 250° F. jacket temperature; 320° F. crankcase temperature.
Ignition setting 5° B.T.D.C.; carb. high speed jet 27.
Amount of oil charged 7 lbs., 6 oz.

Time on conditions	R.p.m.	Intake manifold vacuum "Hg.	Cooling system: To block	Cooling system: From block	Oil temperatures: Pump discharge	Oil temperatures: Sump	Exhaust temp.	Air intake temp.	Room temp.	Blowby temp.
1	1,000	6	240	251	304	304	949	108	84	170
4	1,000	6	241	252	320	313	956	103	79	178
8	1,000	6	242	253	321	315	964	102	81	174
12	1,000	6	240	249	316	312	965	107	84	170
16	1,000	6	240	250	320	316	963	106	84	169
4.0 oz. sample taken. No replenishment required. Fuel consumption measured for 16-hour period.										
20	1,000	6	240	247	307	305	938	110	83	157
24	1,000	6	240	250	325	321	975	107	81	167
28	1,000	6	241	249	323	319	969	110	84	169
32	1,000	6	241	250	324	320	967	110	84	170
4.0 oz. sample taken. 11 oz. replenishment required. Fuel consumption measured for 16-hour period.										
36	1,000	6	245	253	319	315	930	104	83	170
40	1,000	6	243	253	318	313	935	107	80	170
44	1,000	6	241	247	317	310	939	102	78	168
50	1,000	6	241	250	325	319	939	106	77	165

Amount of oil drained 6 lbs., 8 oz. Total fuel consumed 385.3 lbs. = 7.706 lbs./hr.
= .700 lb. b.h.p./hr.

Other observations: Mgs. weight loss cadmium-silver and copper-lead bearing shells.
Combustion chamber deposits.
Condition of piston rings.
When rings stuck, deposits removed from grooves for analysis.

Results of such engine tests constitute valuable substantiation of laboratory tests in cases where the latter either do not check well or are on the border-line of significant corrosion. Naturally, the use of the high crankcase temperature results in more rapid depreciation of the oil. Table 3 shows laboratory tests on used oil from engine tests at 220° F. and 320° F. crankcase temperatures, both at a constant jacket temperature of 250° F.

This change in crankcase temperature has been made only recently, and sufficient data has not been obtained to develop definite constants and final rejection points for the work factor. Tentative figures are shown on Table 2. The formulae used in computing the work factors are shown herewith:

(1) For viscosity change

$$\text{Engine test work factor} = 1.00 - \frac{\text{Final vis./200} - \text{initial vis./210}}{\text{Initial vis./210}} \times C$$

C = 0.95 for 320° F. crankcase temperature.
C = 1.30 for 220° F. crankcase temperature.

(2) For tar, neut. number, and carbon residue changes

$$\text{Engine test work factor} = \frac{\text{F.R.P.} - \text{Final Content}}{\text{F.R.P.} - \text{Initial Content}}$$

Final rejection point = 10.0 for tar; 10.0 for carbon residue; 4.5 for neutralization number, for 320° F. crankcase temperature.
Final rejection point = 2.0 for tar; 3.0 for carbon residue; 4.0 for neutralization number, for 220° F. crankcase temperature.

Summary

The laboratory engine test procedure herein described combines tests for lubricating oil stability, ring sticking, and alloy bearing corrosion. It can be made in a reasonably short time and produces depreciation in oils of such magnitude that differentiation by the usual analytical methods is simple and definite. Results of such depreciation may be expressed quantitatively by means of a work factor.

There is considerable evidence that the potency of various types of sludges with respect to ring sticking differs considerably. The example given herein involves the ratio of 10:1 in sludge formation between highly stable and unstable oils, with a ring sticking ratio of only 2:1. This suggests that certain oils whose oxidation characteristic is predominantly viscosity rise without much tar formation could be perfectly satisfactory up to a point, but that high blowby conditions with high temperatures and possible high carbon content in the blowby, as in diesel engines, might cause cementing of rings in grooves. Below this temperature level these oils will always produce satisfactory results, in that the highly viscous oil in the ring grooves does not readily carbonize. Other oils, which produce hard flaky carbon deposits in ring grooves, may not be so susceptible to such effects from carbon blowby at high temperatures. In the tests reported herewith, the small quantity of oxidation products produced by the stable oil with respect to the unstable oil, gave a result favoring the former by the ratio of approximately 2:1.

TABLE 3—FIFTY-HOUR ENGINE TESTS AT 250° F. JACKET TEMPERATURE—CRANKCASE TEMPERATURES OF 220° F. AND 320° F., AND CHANGE IN WORK FACTOR CONSTANTS TO ACCOMMODATE INCREASE IN SEVERITY OF TEST

Crankcase temp.—	Fresh Oil	220°F.	320°F.
(Same type as Oil 3, Table 1, but different batch)			
Vis./100	445	757	980
Vis./210	61	82 4	89 8
V. I.	96.8	108 8	101.8
Neut. No.	.015	2.184	2.384
Carbon residue	.377	1 500	3.707
% Sludge (86° naphtha insoluble)	....	.410	2.217
% Tar (soluble in $CHCl_3$)	....	.356	2.199
% Dilution	....	1 6	....
Work factor—	(Work factors postulated to be similar to those from tests at 230° F. crankcase temperature to determine constants.)		
Vis./210° F. (C = 1.3)	.543	(C = 0.95)	.543
Carbon residue (FRP = 3.0)	.670	(FRP = 10.0)	.654
Neut. No. (FRP = 4.0)	.455	(FRP = 4.5)	.472
Tar $CHCl_3$ soluble (FRP = 2.0)	.795	(FRP = 10.0)	.778
Average	.616		.612

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1. Lubricating oils studied to determine effect on cylinder and ring wear. C. M. Larson, W. G. Ainsley, M. Fairlie. February 13, 1936, The Oil and Gas Journal.
2. New laboratory unit measures resistance of oil to form sludge. M. Fairlie. March 28, 1935, The Oil and Gas Journal.
3. Mougey, Wolf, and Underwood, of General Motors Laboratories.
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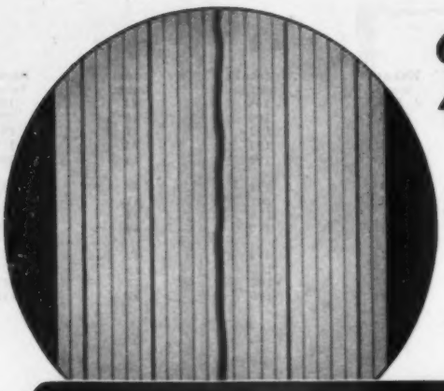
Derricks on Golf Course

AUSTIN, Tex., Mar. 14.—Golfers on the Corpus Christi golf and country club links face added hazards of oil derricks. Prospects of dividends instead of greens fees offset the inconvenience.

Permits for five wells on the club's 73-acre tract in the Saxet Heights field were authorized by the Railroad Commission. The course is 3 miles west of Corpus Christi.

Applications by the Taylor Refining Co., operators, stated the locations were spaced irregularly to minimize interference with use of the golf course. Maps showed greens and fairways instead of the usual offset wells.

This general picture, taken in the Texas City plant of the Pan American Refining Corp., includes most of the present tankage. Included also from left to right may be seen one of floodlight towers, the four burner oil agitators, the open manifold house in the rear center and the light oil doctor sweetening plant consisting of the chemical storehouse, tankage and treating equipment in the foreground



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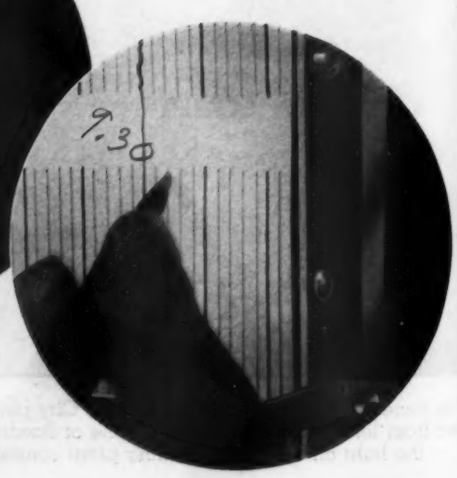


A writing platen under the chart gives a firm support for jotting down notes on the chart.

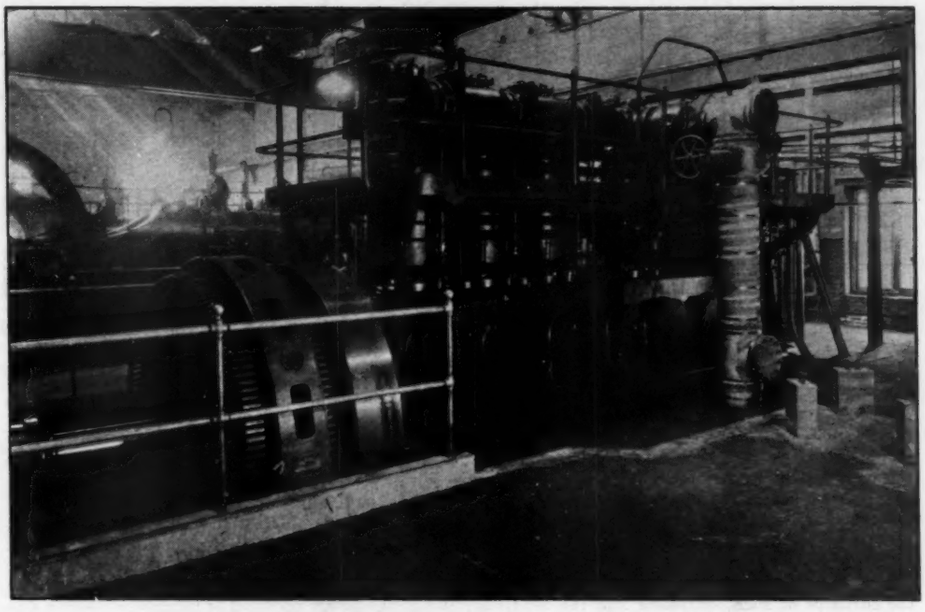
Power Plant Is Becoming Major Item in Large Scale Refinery Operations

Operators of refineries in all parts of the country are giving more consideration to the generation of steam for plant uses and its application along with gas and oil in the production of electrical power. These operators are finding that the possible savings in these utility phases of their plant operations often represent the difference of a fraction of a cent per gallon in cost of output which determine profits or losses.

They have found upon investigation that the progress in the design of steam and power generating equipment has been comparable to that in their main processing operations and the many auxiliaries common to refinery operations. They have been forced to realize, in fact, that the efficient adaptation of many of these new processes to their operations is to a large extend dependent on their position in regard to steam and power facilities.

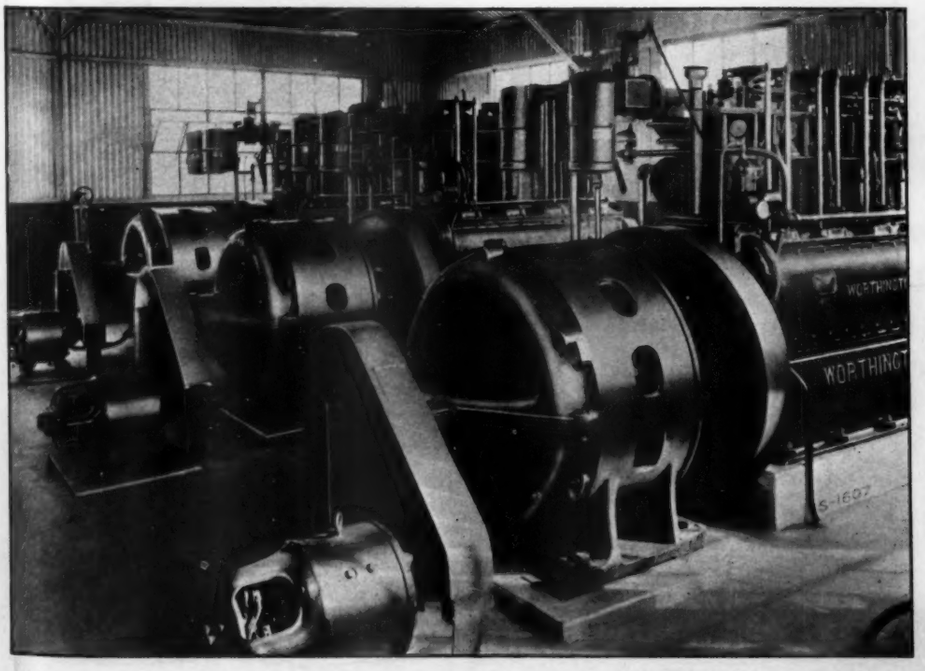
No hard and fast rules can be offered covering recommended practice for steam and power installations in refineries. Conditions vary widely in refineries depending largely on size, scope of operations, water supply, fuel costs and availability of outside power. The position of the small skimming plant handling a few hundred or thousand barrels of oil daily obviously differs in regard to steam and power requirements from the major refinery handling 50,000 to 150,000 bbls. of crude oil daily and manufacturing complete lines of petroleum products. The former plant could be operated with a small quantity of steam for processing and fire protection depending on outside supplies for power. The major refinery is practically forced to be largely self-sufficient in all its plant processing and power requirements with any outside supplies of a supplementary character.

Ever since the first refineries were built, steam has played an important part in their operation. Used for heating and distillation, power generation, pumping, fire fighting, and cleaning and purging of equipment, it is without question the one utility without which no major refinery can function. Over the past few years a survey of the trend in steam production and consumption in oil refineries would closely parallel the developments in refinery methods themselves.



One of the four diesel oil engine-generator units in operation at the Point Breeze (Philadelphia) refinery of the Atlantic Refining Company

The displacement of many small, inefficient steam generating units, operating at low heat transfer rates with virtually no heat recovery from exit gases, by a few large units operating at high heat transfer rates and fully equipped with heat recovery equipment so that fuel efficiencies of well over 80 per cent are maintained during normal operations, is equivalent to the displacement of low pressure batch and continuous shell stills by the modern, high capacity pipe stills with their numerous provisions for efficient heat utilization. Greater heat efficiency of refinery equipment has resulted in reduced process steam consumption, but the marked trend toward higher throughput, greater use of heat recovery equipment and higher operating pressures of some processes has greatly increased the requirements for power to drive the pumps and other mechanical equipment.



Gas engine driven generators in power plant service at the Willow Springs, Tex., refinery of the Premier Oil Refining Company

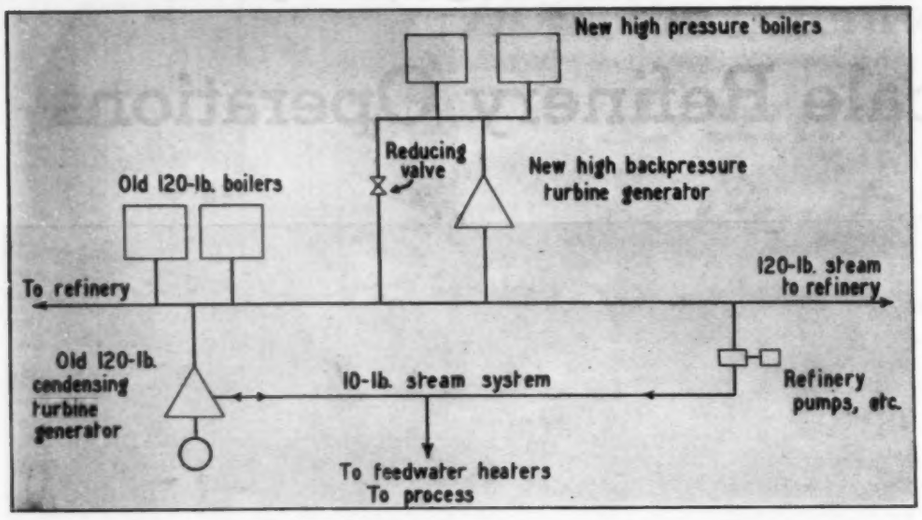
The trend in electric power consumption in refineries is definitely upward. To provide the motive power, refiners are finding that it usually is advantageous to generate electric power, in a few centrally located units and distribute it to motor-driven equipment rather than to use steam-driven equipment. This is especially true in the case of smaller pumps. The rapid strides made in the development of centrifugal pumps for refinery service has helped much in making electric power such a useful utility. The development of the explosion-proof motor also has been an important factor. Naturally, many refiners find it advantageous to rely partly on purchased power, thereby keeping to a minimum the investment in the electric system of the plant. Consideration must also be given to the fact that in many instances oil and gas engines are ideal prime movers, either for driving electric generators or for direct connection to pumps and compressors.

The question of steam and power supply in a refinery is in no small way complicated by the fuel problem. All refining processes produce wastes, most of which are high in heat value. Some, such as gas, coke and light sludges resulting from the treatment of naphtha and light distillates can be burned easily with standard commercial

equipment. Other wastes, such as the sludges resulting from the acid treatment of lubricating stocks and tank bottoms, are very difficult to burn and can only be handled by specially designed equipment. Other wastes are high in noncombustibles and cause excessive fouling of heating surfaces. No matter what the wastes may be, refiners usually find it more economical to burn them rather than to dispose of them in some other manner.

The increasing necessity for close control of temperatures in refinery equipment makes it impracticable to burn the poorer quality wastes in the furnaces of such equipment and the tendency is to try to dispose of it entirely in the boiler furnaces. Not only are the boilers supposed to function as incinerators but they are asked to perform this function efficiently. That the problem is becoming more difficult each year is due to the fact that more rigid specifications require more treating with a resultant greater production of wastes. Greater over-all refinery heat efficiency means that wastes constitute a greater percentage of the refinery fuel supply. With all the better grade wastes reserved for processes, it means that each year will see greater percentages of low grade wastes being consumed in the boiler furnaces. That refinery engineers are able to burn these low grade wastes at all attests to their ingenuity, as very little commercially available equipment has been found suited for handling them. One method which promises to be more generally used in the near future consists of grinding very heavy wastes in intimate contact with lighter ones and aerating the resultant colloidal mixture.

The trend in design of burner installation is to assure as much flexibility as possible in the matter of fuels. Recent installations have provided for the use of refinery coke, regular fuel oils and oil sludges and refinery gas. Much attention is being paid to costs and two cases are cited in which arrangements have been made to use coal should fuel oil prices advance to the point where the management will dispose of all oil fuels outside their plants.



Simplified refinery steam system with high pressure boilers and turbines superimposed on the old low pressure equipment

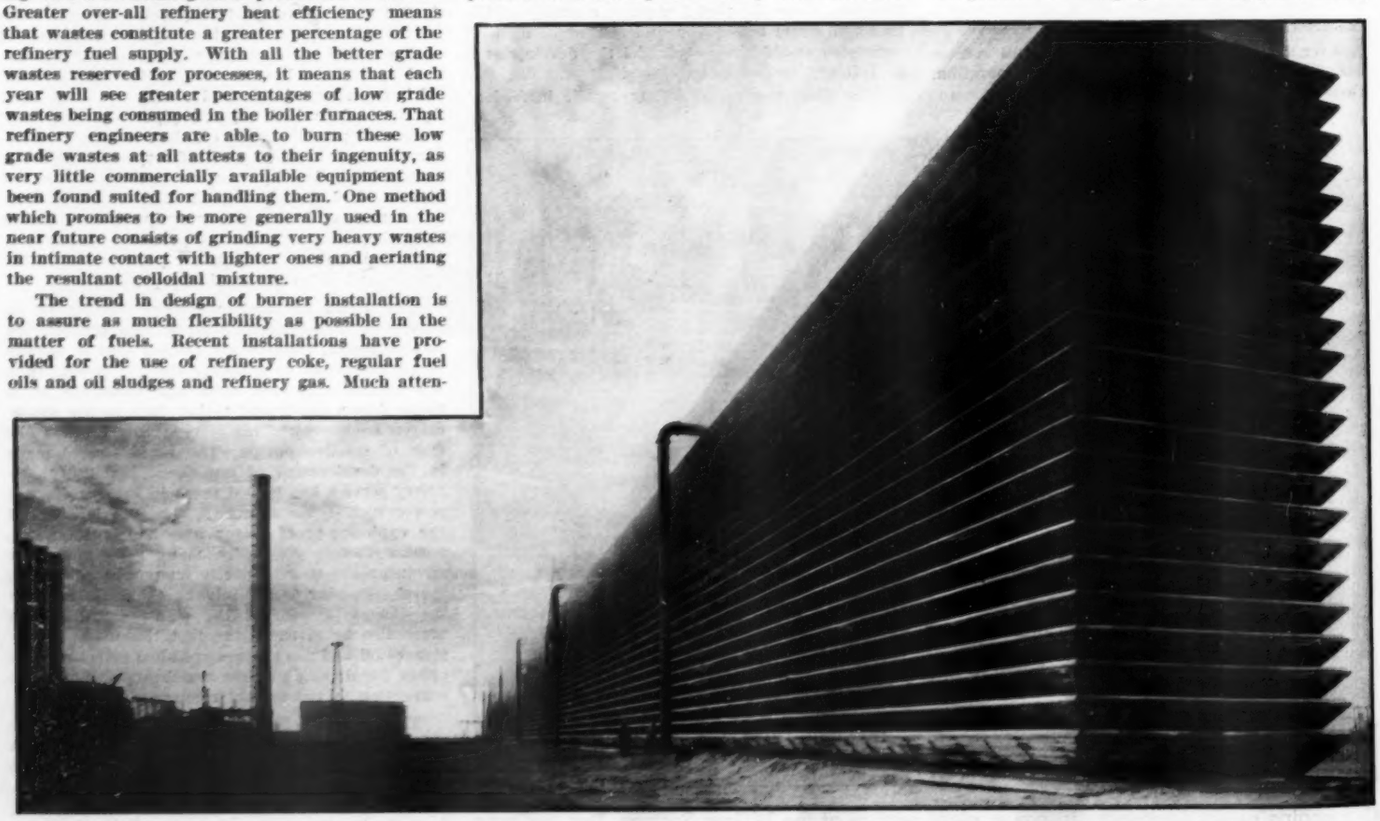
High Pressure Steam

Until 1926, refinery steam plants operating at pressures in excess of 200 pounds were almost unheard of. Since then there has been a marked trend toward higher pressures, which is a direct sequel to the facors discussed previously. Steam consumption, per barrel of crude run, is decreasing while the power required is increasing; partly due to the substitution of electric driven equipment for less efficient steam driven equipment. The high back-pressure turbine, the bleeder turbine and the mixed flow turbine have been developed to a high state of perfection during the last decade, the oil industry supplying the major portion of the impetus to this development. Many refineries have found it logical to combine high pressure steam generating equipment and high back-pressure turbines to take advantage of the gain in efficiency afforded by such a scheme. The oil industry is not alone in adopting this method to cut operating cost. This method is well established in paper mills, in sugar refineries and in the textile industry.

As an example to illustrate the fuel saving to be made by generating steam at a high pressure and producing power therefrom in noncondensing turbines, as compared to low pressure steam generation and production of power in condensing turbines, let it be assumed a refinery required 350,000 pounds of steam at 120 pounds pressure and 50° F. superheat and the power load is 10,000 kilowatts. Were the steam load to be supplied by low pressure boilers taking feed water at 212° F. and operating at 80 per cent efficiency, 70.3 bbls. of fuel oil would be required per hour. To produce the power, additional steam would have to be generated to supply a condensing turbine. This steam would necessitate the burning of an additional 26.2 bbls. of fuel oil per hour, making a total refinery fuel demand of 96.5 bbls.

If the steam for the refinery were generated at 650 pounds pressure and 750° F. and were passed through a high back-pressure turbine exhausting at 120 pounds pressure and 50° F. superheat, 80.6 bbls. of fuel oil would have to be burned. This is only 10.3 bbls. more than required to produce the same quantity of steam at 120 pounds initially. The 350,000 pounds of steam passing through the turbine would easily generate 10,000 kilowatts, including all requirements for auxiliaries. It is apparent that power is being generated at an extremely low fuel rate, saving 15.9 bbls. of fuel oil per hour. The saving is possible due to the fact that the condensing turbine rejects a large quantity of heat to the cooling water, whereas the noncondensing turbine rejects heat at a high level in steam which is used in the refinery.

From the foregoing it might appear that the question of cheap steam and power in a refinery is simply a matter of going to a high enough steam pressure so that all power can be generated noncondensing. That might be the case in a new refinery where suitable equipment could be picked for the operating conditions. In practice, however, the refinery engineer is usually faced with the problem of enlarging an existing plant, adding



Cooling tower 1,000 feet long at the Texas City plant of the Pan American Refining Co. This handles 37,500 gallons of water per minute

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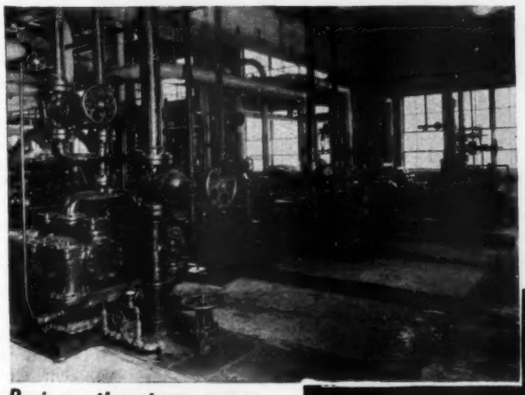

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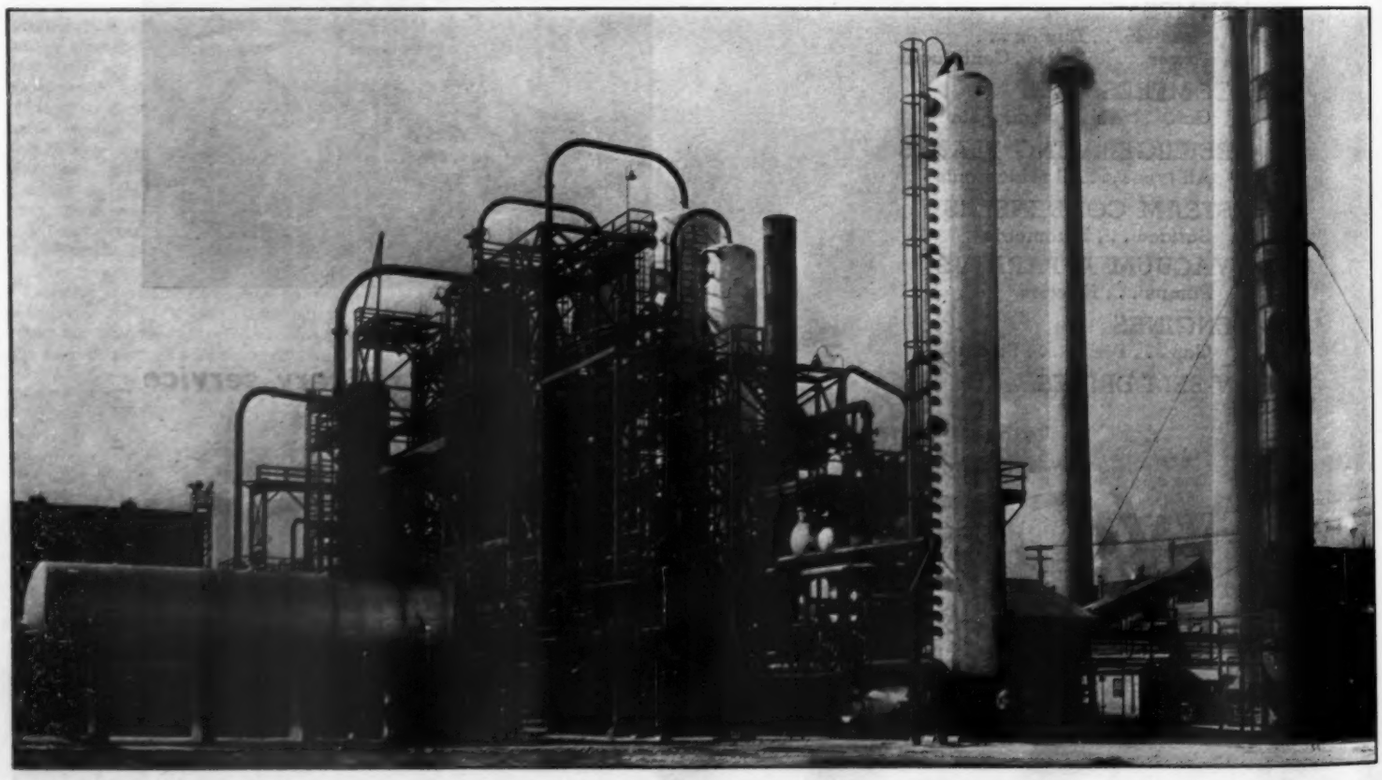
only enough new equipment to earn the maximum return on the minimum investment, with no provision for standby other than that provided by existing, often obsolete equipment. Such a problem is much more difficult, especially when one considers the ever changing conditions in refinery operation.

To maintain a perfect balance between steam and power demand is impossible. At one moment a steam heated reboiler may be shut down, decreasing the steam demand by 10,000 pounds per hour. The next minute a pump of a cracking unit may be started, adding 1,000 kilowatts in a few seconds. To meet these changing conditions, the refinery steam and power system must be designed with a great deal of thought given to flexibility. Usually, it will be found necessary to make provisions for generating a portion of the load condensing, so that in case of high power load and low steam demand, the power requirements can be met. Also, it is usually advisable to provide means for supplying the low pressure steam system from the high pressure boilers directly, without passing through the turbines. This provides for occasions when the power load may be small and the steam demand high. To illustrate, the accompanying diagram shows a typical arrangement where high pressure equipment was superimposed on a low pressure system of conventional design. Such an arrangement gives ample flexibility, reduces the investment in spare equipment to a minimum and permits efficient operation over a wide range of loads.

Principal electrical control panel in the powerhouse of Pan American refinery, Texas City

The trend in boilers for refineries has closely paralleled that in central stations and in other industries, with the exception that furnace volumes are probably more liberal and that bent tube designs predominate. Also, air heaters have usually not met with much favor. These can be all ascribed to fuel and water conditions. The poor grades of waste fuels require large furnace volume for satisfactory combustion, and heat releases much above 22,000 B.t.u. per cubic foot of furnace volume per hour are difficult to attain. The fuels contain high percentages of acid and sulfur, and air heaters as a result corrode or become fouled too rapidly. Water conditions in most refineries are adverse and the percentage of make-up usually varies from 80 to 90 per cent. Boilers of bent tube design have generally been favored on this account.

Water cooled furnace walls have been quite generally adapted and as a result refractory maintenance has been cut to negligible amounts. In cases where air heaters are not used, overall efficiency has been maintained by using large economizers, some having as much surface as the boiler and water cooled walls combined. Superheaters have been of conventional design to give steam temperatures from 650° to 750° F. To date there has been no need for pressures in excess of 740 pounds or temperatures in excess of 750°, so just what the trend will be in the future is un-



With the recent completion of a new crude topping unit shown in the foreground above the Shell Petroleum Corp. is equipped to handle 56,000 bbls. of crude daily in its Houston refinery

certain. It is probable that this will represent the upper limit for boilers for refinery service for some time to come. Higher pressures involve greater power consumption for auxiliaries and greater feed water difficulties. Temperatures above 750° involve more expensive materials for piping, turbines, etc. The gains from higher pressures and temperatures will probably not be sufficient to warrant the greater investment and operating costs with present fuel prices.

The trend in turbines for refinery service closely parallels that in other process industries. Sizes range from 2,000 to 10,000 kilowatts and practically all recent installations are for steam pressures above 400 pounds. The high back-pressure turbine and the extraction turbine has become firmly established as an important factor in providing low cost power, and it is to be expected that most units in the larger refineries will be of this type in the future. The wide variations in process steam demand and changes in power requirements necessitate considerable flexibility in such units and a number are now in service from which steam can be extracted at several pressures. One is now being designed to provide not only two extraction points, but will have governors so that steam can be induced at these points and can also be operated as a straight condensing unit. The reliability of turbine generator units for refineries is an important consideration, and when one considers that feed water conditions in most plants are adverse and make-up percentages are high, and consequently the carry-over of solids from the boilers is appreciable, the performance records of many units are a tribute to the skill of turbine designers and refinery operators alike. Records of machines operating two and three years without a shutdown are not rare: such reliability has done much to stimulate electrification of refinery equipment.

Types of Engines

As pointed out previously, there are cases where either oil or gas engines can be used to advantage. On a thermal efficiency basis, an internal combustion engine can ordinarily compete with a condensing turbine only. To compete with a high back-pressure turbine, a large percentage of the heat in the exhaust and in the cooling water would have to be recovered. There has been no marked tendency toward the use of internal combustion engines for power generation, but they are used extensively for driving pumps and compressors. Even in fully electrified refineries, such units can have a definite place in standby or peak load service or in cases where gas would otherwise be wasted. They are entirely independent of the steam and power system and are extremely reliable. The engines used for refinery service are usually of the type used in oil fields and for pipe line stations and are simple to operate. As the trend in power generating units in refineries is definitely to sizes in excess of 2,000 kilowatts, it is doubtful if the oil and gas engine will ever be a major factor in this field, except for small refineries and special applications in large refineries.

The accompanying two photographs show installations of diesel and gas engine power units at refineries. Four of the Ingersoll-Rand-General Electric oil engine generators have been in operation at the No. 1 power plant of the Atlantic Refining Co.'s Point Breeze (Philadelphia) refinery for several years and have given satisfactory service. This refinery is one of the oldest and largest refineries of the petroleum industry. Steam generating units also are in operation at the refinery.

The gas engine generators are located at the Willow Springs, Tex., refinery of the Premier Oil Refining Co. This is a small refinery. Electric power is furnished by three 120-horsepower 9x10½ Worthington BG4 vertical gas engines driving Allis-Chalmers 80-kilowatt generators. The engines operate on pipe line gas. These engines are also equipped with carburetors so that they can be operated with gasoline.

Feed Water Systems

In most refineries a large percentage of the steam required is used for processes in such a way that the recovery of condensate is impossible. For this reason make-up water requirements in most cases are from 80 to 90 per cent of total steam demand. To supply such a demand is no small problem especially when high pressure boilers must be operated for long periods at high ratings.

Many refineries have developed their own sources of water and are successfully using this water in high pressure boilers, after a carefully controlled treatment for cooling and heating. In a few instances it has been found necessary to distill sea water to obtain suitable boiler water. In these cases the refineries are almost 100 per cent electrified in order to reduce the make-up requirements to the minimum.

In regard to water treatment, methods in refineries are similar to those followed in other industries where large quantities of make-up are required. Those plants having their own water sources which usually involve the collection of water run-off, require ample settling facilities.

Water Supply

An adequate supply of water suitable for use in refining presents a problem of immense importance. Water is a universal solvent and may contain every metal that is known to the chemist. Some of the substances such as sodium chloride and calcium carbonates are quite common, while others such as gold and radium are relatively rare. However, it is fortunate that water for making steam, flowing through the condenser boxes as a cooling medium, or for the general purposes of the refinery, may be considered from the standpoint of a few mineral elements and their salts. Any water that is suitable for making steam will be found satisfactory for other purposes in petroleum refineries. Therefore, when considering the quality of water for a refinery it is the common practice to look at the water from the standpoint of its suitability for use in the boilers, and any treatment applied to the purification of the water is done from this viewpoint.

The elements ordinarily determined by the water analyst include sodium, calcium and magnesium, and the total mineral content together with the quantity of the chlorides, sulfates, carbonates and bicarbonates. In order to reduce these substances to a condition and quantity that will be satisfactory when used in the steam boiler, it is necessary in many instances to apply what are known as treating methods. In some instances it is necessary to remove a chemical compound normally present in the water, and in others to convert a salt to some other salt that will not do so much damage. Some examples will serve to illustrate. Calcium oxide or ordinary lime may be added to a water containing magnesium bicarbonate for the purpose of combining with part of the carbon dioxide to form calcium carbonate which is insoluble, and therefore precipitates to be easily removed by the water softening unit.

The purification of water containing lime bicarbonate or magnesium carbonate by the lime (CaO) method is illustrated thus:

$$H_2O + Ca\ CO_3 . CO_2 + CaO = 2\ Ca\ CO_3 \quad \text{(insoluble)}$$

$$H_2O + Mg\ CO_3 + CaO = CaCO_3 + Mg\ (OH)_2 \quad \text{(insoluble)}$$

One of the most interesting and valuable water treating processes makes use of a mineral substance called zeolite. The principle behind this method is what might be termed a "base exchange." The mineral zeolite has the power to extract calcium and magnesium from water filtering through it and exchanging these bases with sodium contained in the mineral.

This exchange continues until no more sodium is available and then the zeolite material is regenerated by passing a solution of salt (NaCl) through it. These changes may be explained by the equations.

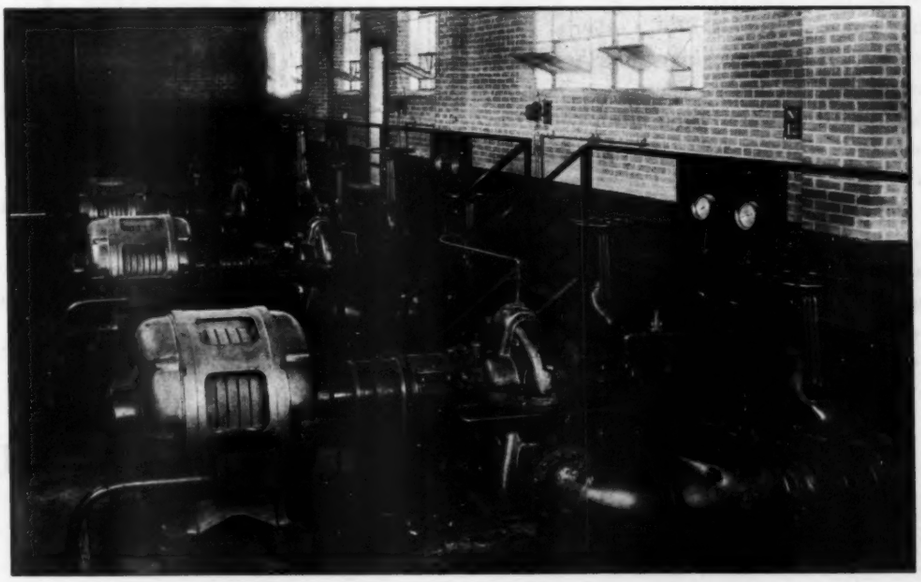
$$CaSO_4 + 2NaZeolite = Na_2SO_4 + CaZeolite$$

$$CaZeolite + 3\ NaCl = NaZeolite + 2\ NaCl + CaCl_2$$

There are many instances where settling methods and filters are required to properly treat water to be used in the steam boilers and condensing systems of the refinery. Each water supply is a treating problem in itself and should always have the advantage of scientific inspection.

The volume of water required in the modern refinery is very large. The complete refinery may circulate so much as 10,000,000 gallons of water per day for each 20,000 bbls. of oil passing through the refinery. This volume of water is carefully conserved so that the additional water required from day to day as make up is not too large. Several refineries report that the makeup water varies from 8 to 20 per cent of the water circulating.

Chemical treatment is closely controlled and in most of the higher pressure installations external treatment is supplemented with internal treatment. Blowdown procedure has been fairly well standardized and frequent checks are made on boiler water concentrations in various portions of the boilers. To reduce the amount of blowdown, most refineries operate their boilers with concentrations in excess of what is considered safe practice for central station practice. Service factors of boilers have nevertheless been satisfactory in most cases and instances are known where boilers have operated continuously for a year with concentrations in excess of 5,000 parts per million. This is only possible in very liberally designed boilers with free water circulation, furnace volumes large enough to keep furnace temperatures down to conservative figures.



Five of the six large centrifugal pumps used for loading at the Texas City refinery of the Pan American Refining Corporation

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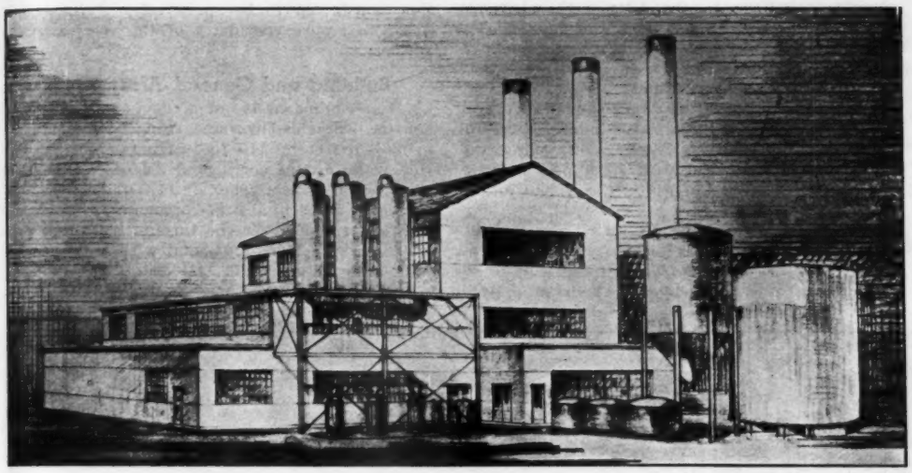
BETTER OILS FROM THE GROUND UP!

New By-Product Power Plant for Standard of California Refinery

By JOSEPH POPE
Consulting Engineer, Stone & Webster Engineering Corp.

A new power station is now under construction at the Richmond refinery of the Standard Oil Co. of California. It will be placed in operation during the summer of 1936 and represents the most advanced stage of power plant design applied to the needs of a large oil refinery.

The Richmond refinery is the largest on the Pacific Coast. At the present time a great deal of steam is used at low pressure in the refining process, being first used in even larger amounts for the operation of pump drives and other apparatus. The quantity of steam involved in these operations is of the order of one-half million pounds per hour, and, of course, as refinery operation is continuous the annual load factor is high. Something more than 3,000 k.w. average demand of electric energy is purchased for additional power and lighting purposes. Steam is generated in three boiler houses at 105 pounds and 150 pounds pressure, but no electricity is now generated. Two of the boiler houses are quite old, and are equipped with numerous horizontal return tubular boilers. The third boiler house contains 10 bent tube boilers, each of about 30,000 pounds per hour steaming capacity, and is capable of continued operation at good efficiency and reasonable overall cost.



Drawing of power plant to be built by the Standard Oil Company of California

Although there is already a considerable degree of electrification in Richmond refinery, as indicated by the purchased power demand, there will shortly be an even greater use of electricity, brought on by the substitution of motor drive for steam and the better balancing to the actual need therefore of the quantity of exhaust steam available for processing purposes. New processes being installed in the refinery will also require a considerable supply of electric power so that the total demand is expected to be about 7,200 k.w. and the annual consumption about 46,000,000 kilowatt hours.

Much thought and study was given to the determination of how this load could best be served. An isolated plant, if constructed for the purpose, had to possess high reliability, give good quality of service and be adaptable to any of the likely future needs of the refinery. Most important of all it had to show an acceptably short payout period.

The ability to make large savings in the cost of power, and thus bring about quick payout, re-

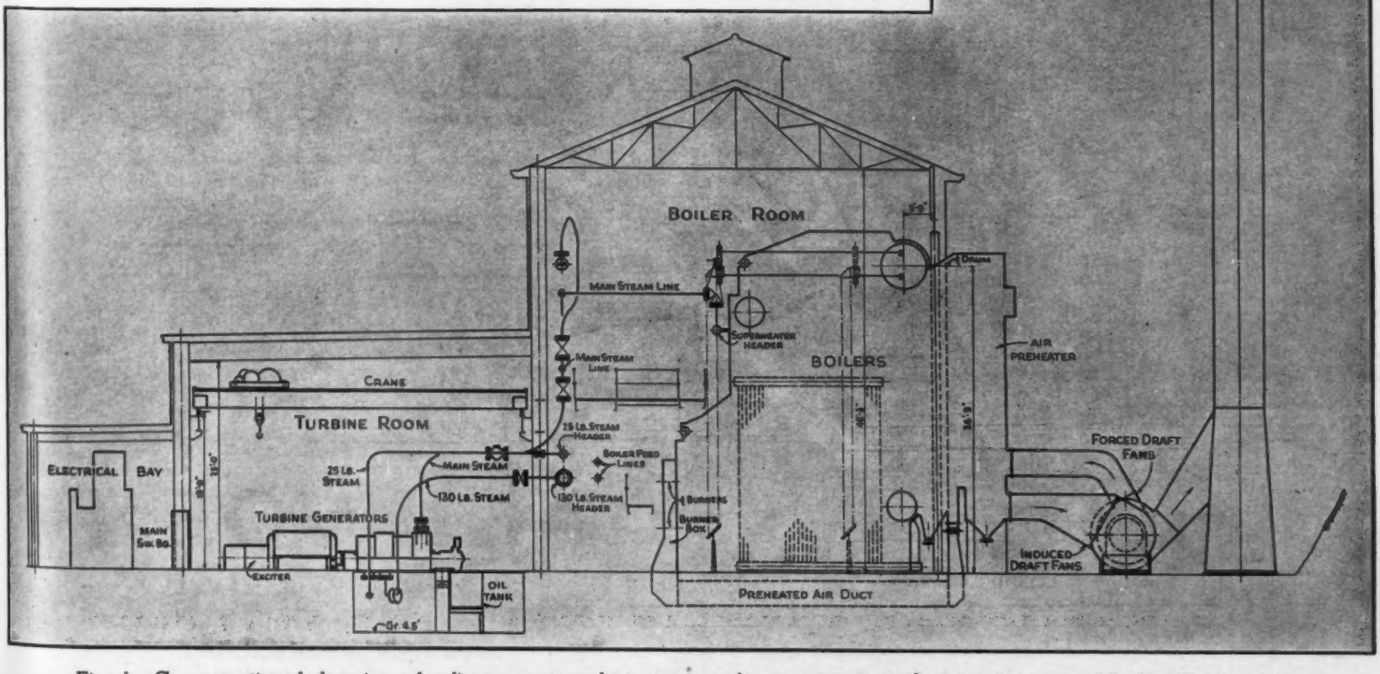


Fig. 1—Cross sectional drawing of refinery power plant, now under construction, showing location of boilers and turbines

sides principally in the fact that the steam necessary in the refining process can be used as a vehicle on which the additional energy required for the actual production of electric power can ride as a by-product. By-product power can be produced by the consumption of not more than 5,000 B.t.u. per kilowatt hour or approximately 1,250 k.w. hours per barrel of fuel oil. This is, of course, extraordinarily cheap under any normal price basis for fuel, being only one-half mill per kilowatt hour with oil fuel costing 62½ cents per barrel. There is nothing inherently novel about making by-product power. It is exactly what a refinery does when it drives a pump with steam that is later profitably, or necessarily, employed in process. Supplying steam at pressures and temperatures higher than usual to the throttle of a prime mover so that it is exhausted to the yard mains at normal conditions for further use, is only carrying the idea a step further. The exhaust pressure is usually pretty definitely fixed by prevailing conditions so the throttle pressure has to be selected high enough to permit generation of the required power with the available steam flow. The initial superheat is selected so as to give the desired temperature of the exhaust to the refinery steam distribution system.

A secondary but sometimes very important saving comes from the replacement of the oldest and least efficient boiler plants in the refinery with modern facilities for steam generation. It sometimes happens that a new high pressure power plant can supply to the yard as much steam as an old boiler house, and all of the necessary electric power besides, with the consumption of ne more fuel. In such situations, as a practical working out of the matter, the energy is in effect free of all cost for fuel.

In a by-product power plant once initial steam conditons are reached that will supply the needed power with the available quantity of steam there is no improvement of efficiency to be had from further raising the pressure or increasing the temperature. However, it is entirely possible that trends are toward increased future use of electricity and decreased need for steam. There is also the probability that maximum demands for electricity will not coincide with the heaviest steam demands.

Prudence, therefore, suggests that initial steam conditions be selected high enough to permit the occurrence of all these factors to a reasonable degree. That has been done at Richmond refinery and the electric energy estimated to be necessary, after the present electrification is completed, can all be generated by the flow of only about one-half the remaining steam consumption.

There was much comparative study of the merits and cost of various steam pressures, with the result that a nominal pressure of 900 pounds per square inch was selected. There have been many installations in the 550-650 pound range in industrial and utility service. One oil refinery, Tide Water at Bayonne, had used 700 pounds as had Monsanto Chemical at St. Louis. Goodyear Tire & Rubber at Akron and Solvay Process at Syracuse had employed about 750 pounds. Several utilities and at least three major industrials, Firestone Tire & Rubber at Akron, Ford Motor Co. and Dow Chemical had used 1,300 pounds pressure or thereabouts, and Philip Carey had an installation at even higher pressure. All of these plants above 650 pounds pressure, except Tide Water, fed their boilers either with good condensate or with coil drips from process steam evaporators. There is a considerable body of experience with the chemical treatment of boiler feed water in plants of the 600-pound class with approximately 100 per cent make-up. The water supply at Richmond refinery is of generally high quality. Chemical treatment of it can be relied upon to produce satisfactory boiler feed with steam pressures at least as high as 900 pounds. On the other hand if the pressure were pushed up into the 1,200-1,400 pound range process steam evaporators undoubtedly would be required.

A 900-pound boiler working pressure is further indicated by the already established series 90 line of valves and fittings and by the arbitrary division between steam turbine price classes, by agreement between the manufacturers, at 850 pounds per square inch throttle pressure, the next lower division being 650 pounds. Thus no premium is paid for suitability for high pressure of which use is not actually made.

The new power plant consists of three 4,000 k.w. noncondensing turbine generators, and three 125,000 pounds per hour boilers with necessary related apparatus. One boiler and one turbine are now considered to be spare relay equipment in order to assure continuity of the service to the refinery.

Building and General Arrangement

Most equipment is out of doors but in general housing is provided by a steel framed building measuring 100 feet by 110 feet in plan. The building side walls are of corrugated asbestos board and steel factory sash. The steeply pitched roof of the boiler room is also of corrugated asbestos but the flatter roofs over the turbine room and electrical bay are insulated metal with built-up roofing on the weather side. All operating equipment is at ground level but access to overhead valves

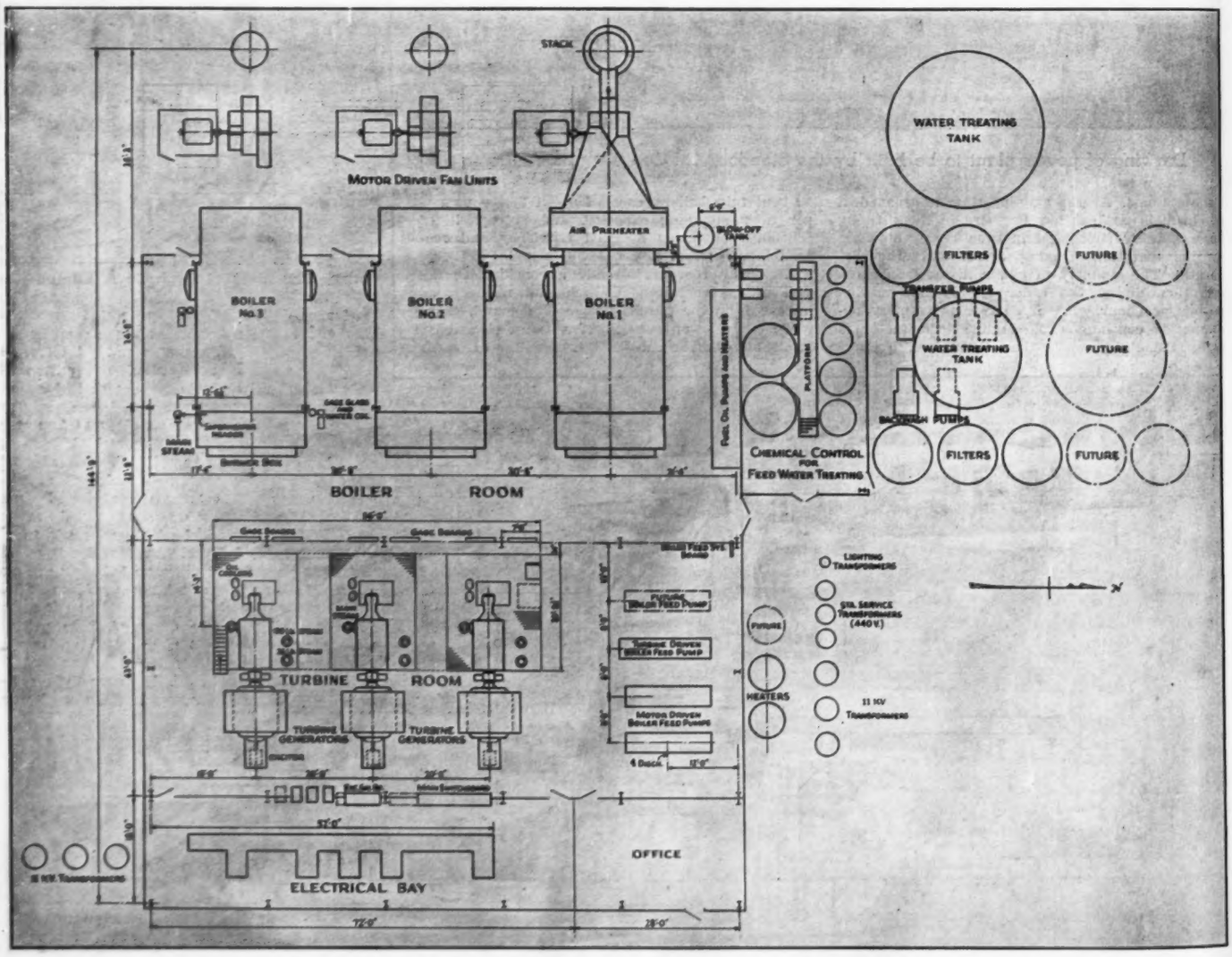


Fig. 2—Layout of power plant showing location of water treating equipment with respect to boilers

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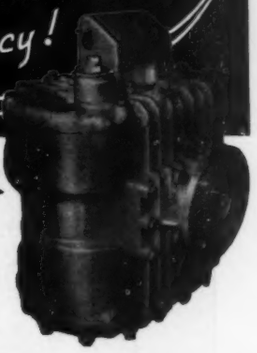

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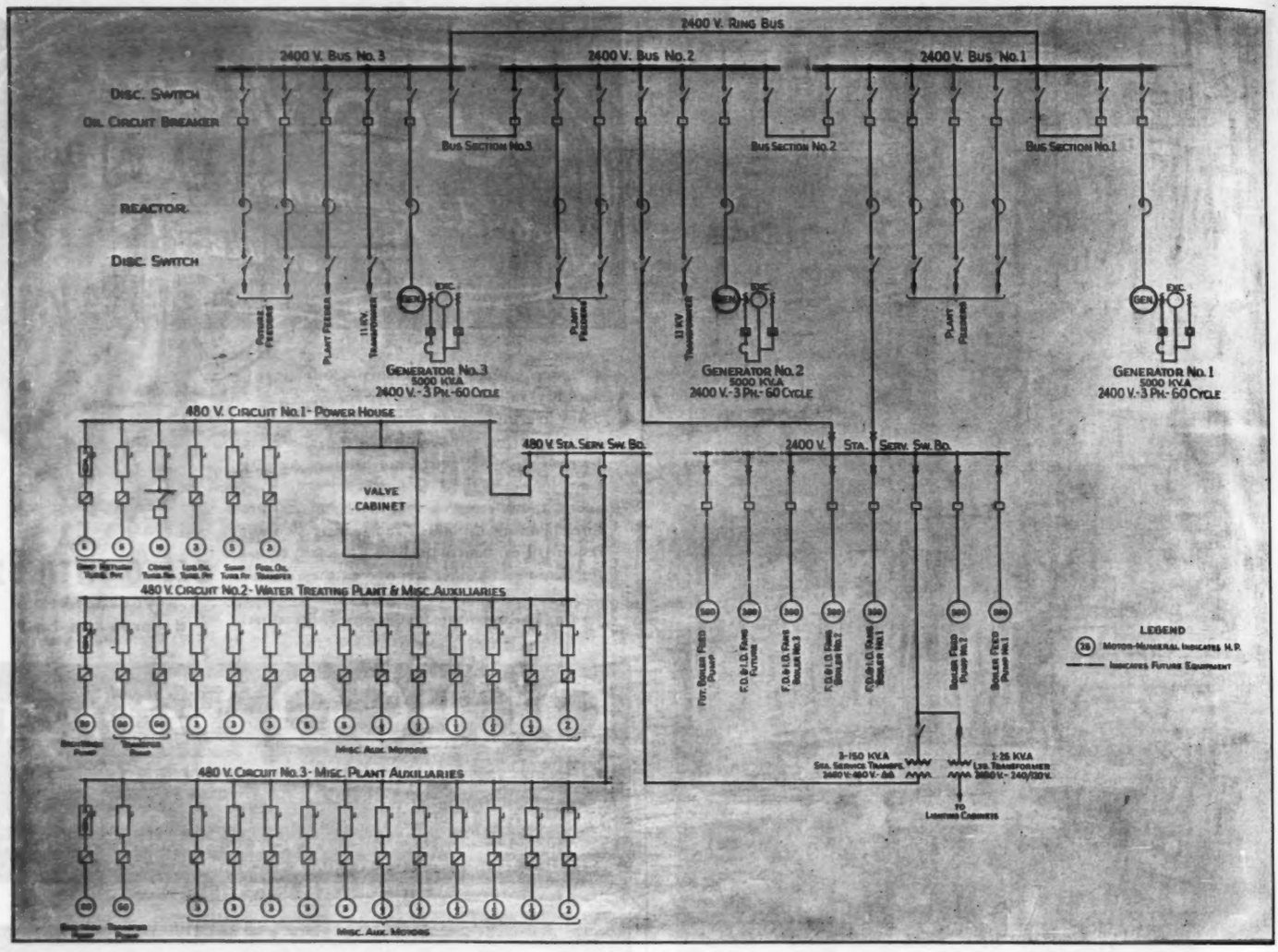

Fig. 3—One line diagram of electrical circuits showing location of the three service circuits

and inspection openings in the boilers is provided by convenient stairways, ladders, and grating walkways.

The ground floor and all foundations and column footings are of reinforced concrete. The building and all other structures are designed to resist earthquake shock.

The boilers are set singly with 12-foot aisles between them. The firing fronts face the turbine room and there is no partition between the two rooms. This improves light and ventilation and gives complete freedom of observation and movement to the plant operators. Boiler and turbine gauge boards are concentrated on the line of columns between the two rooms. The air preheaters at the rear of the boilers are out of doors, as are the forced and induced draft fans. Shelters are provided over the fan driving motors.

The turbine generators are set with their axes across the turbine room making a convenient disposition of their steam and electrical ends. The only sub-grade space in the station is abreast of the turbine steam ends to permit getting exhaust steam piping and electric leads away from the units in a ready manner.

The boiler feed pumps, which are of relatively large physical dimensions, occupy the permanent end of the turbine room, with enough space for a future pump if it is ever needed.

A 15-ton overhead traveling crane is installed in the turbine room.

A lean-to 18 feet wide, forming an electrical bay for housing the bus and switching apparatus and providing space for offices, toilets and locker rooms, extends the full length of the building parallel to the turbine room. The electric switchboard forms part of the partition separating the two rooms.

The water treating plant is largely outdoors at the permanent end of the building.

Figures 1 and 2 show the general arrangement of the power plant and contained apparatus and need no special comment here.

Boilers

The boilers are of the three drum bent tube type. They are equipped with full water walls on the furnace sides and upper front. The total effective water heating surface is about 10,800 square feet. The designed maximum working pressure in the drums is 906 pounds per square inch gauge. At the outlet of the superheaters it is expected that the operating steam conditions will be 850 pounds gauge pressure and 750° F. total temperature. The boiler drums are fusion welded, two in each boiler being 36 inches inside diameter with shells 2⅛ inches thick and the third 60 inches inside diameter and 4 1/32 inches thick. The boilers are equipped with 12,000 square foot tubular air preheaters to give a combustion air temperature of 440° F. and an exit gas temperature of 425° F. when the boilers are producing rated output. The heated combustion air passes under the refractory furnace floor to the burner blast box in front.

Five combination gas and liquid fuel burners are placed in the lower front wall of each boiler furnace, which is of supported refractory construction. The burners are of the forced draft register type and each one is equipped with a ring type burner for natural gas, either straight or mixed with refinery gas. In addition there are steam atomizing "guns" for insertion in the centers of the registers for firing fuel oil and the several refinery refuse sludges which will constitute a large part of the fuel burned in the new plant.

Draft is supplied for each boiler separately. Each unit is equipped with forced and induced draft fans with shafts coupled together and driven at a common speed by a slip ring motor of 300 horsepower operating at 2,300 volts. The slip ring feature is only to provide easy starting characteristics, draft regulation being by means of fan inlet vanes. The induced draft fans discharge to individual self-supporting steel stacks set on the ground, 6 feet diameter by 125 feet high, and fully brick lined to resist corrosion. Flues, fans, and air preheaters are heavily lagged outside for the same reason.

Turbine Generators

The steam turbines are rated 4,000 k.w. at 3,600 r.p.m. The steam conditions call for 825 pounds gauge pressure and 750° F. total temperature at the throttles. Initially the turbines are to exhaust at 130 pounds gauge pressure, but they may be converted later into automatic extraction units bleeding at 130 pounds gauge pressure and exhausting at 25 pounds pressure. To this end they have been purchased with provision for the addition of extraction control apparatus and with blank wheels in place on the shaft for the possible future low pressure stages. Present exhaust will therefore be through the future extraction opening and during operation the low pressure end will be vented to a refinery steam system which is now carried at 10 or 12 pounds pressure.

The generators are 5,000 k.v.a., 3-phase, 60-cycle, 2,400-volt machines and the direct connected exciters are rated 25 k.w. at 125 volts. The closed system of ventilation is employed on the generators and the exciters have been completely housed and included in the circuit to protect them from the refinery atmosphere. The extended surface coolers are mounted at the sides of the generators as there is no basement in the station at this point.

Three boiler feed pumps are provided, two

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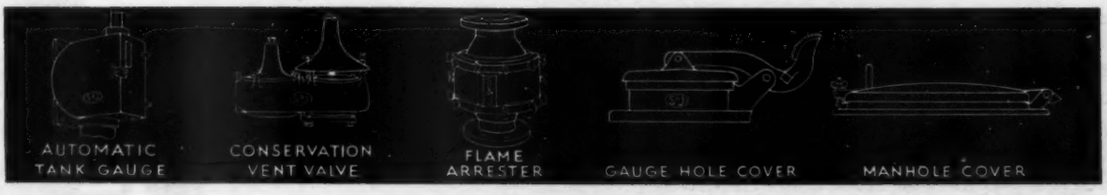

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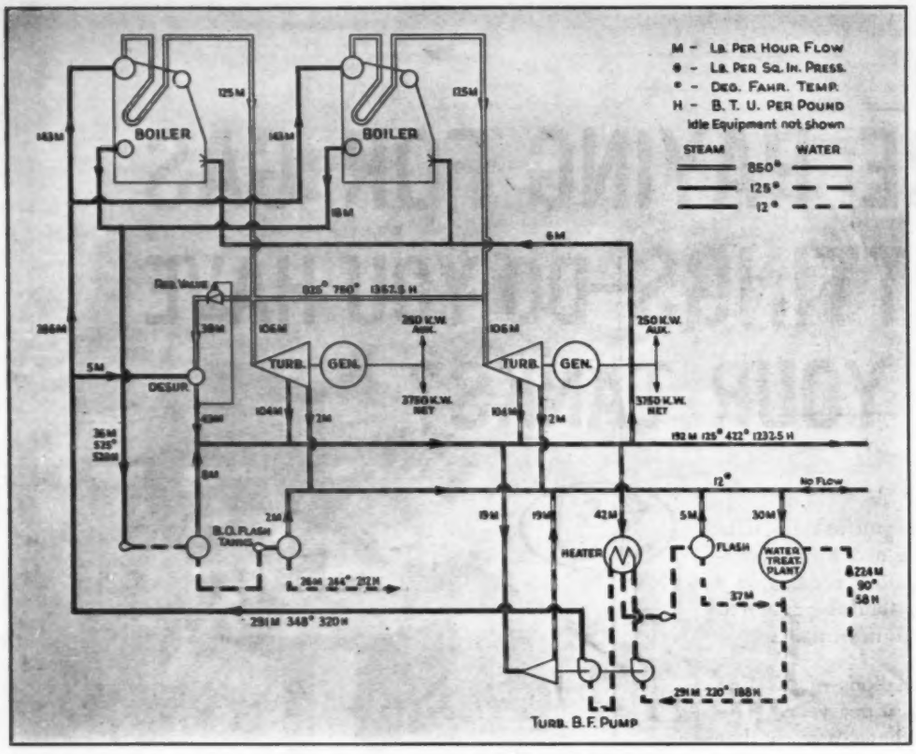

Fig. 4—Flow diagram for steam facilities

being driven by electric motors and the third by a steam turbine. Each pump has a capacity of 300,000 pounds per hour capable of feeding two boilers at full load with adequate margin for a large continuous blow down. There will thus be an actual spare unit available even when one pump is dismantled for repairs. The turbine and motors are of 500-horsepower capacity at 3,500 revolutions per minute.

The motors are 2,300 volt units of the wound rotor type, for favorable starting characteristics. The turbine is a low pressure machine, taking steam from the 125 pound pressure main and exhausting to the 12 pound main. This provides a simple and relatively inexpensive steam standby which can be operated with steam from either the new or old boiler plants.

The water ends actually consist of two pumps operating in series and driven in tandem. The primary unit is a single stage double suction pump receiving water at about 220° F. from the deaerating hot process softener. It is discharged through a closed heater to the suction of the secondary unit, which is a seven stage single suction pump. The heater is supplied with steam from the 125-pound main and the water temperature rises to about 350° F. between the two elements of the pump, at which temperature it is fed to the boilers. In this manner are avoided the initial cost and the operating difficulties inherent in heaters installed in the high pressure pump discharge and operated at 1,000 pounds water pressure.

The water supply available for boiler feed makeup purposes at the Richmond refinery appears to be of very high quality. Of course, all of the water fed to the boilers except the steam condensed in heating it is makeup water. The analysis of the raw water changes somewhat with the season but the total dissolved solids are at all times fairly low. This fact had a profound influence upon the design of the power plant for the ability to condition the raw water chemically into suitable boiler feed fixed the steam pressure, permitted omission of evaporators between the turbine exhaust and the refinery and materially reduced the first cost of the station.

The principal dissolved solid in the feed water that might cause trouble in the steam plant, both from its absolute amount and its seasonal variability, is silica. Special treating methods for removing the silica in the cold raw water are to be employed, and the use of quartz sand in filters is especially avoided. After treating for silica removal the water will pass through a hot process softener and deaerator.

The several piping systems are simple and direct as possible. In general two methods of accomplishing each necessary function are provided, and every valve is so protected by an-

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other so that access can be had to it without interrupting service from the station.

The steam connections between boilers and turbines are arranged on the unit system with interconnections. The turbines exhaust into a main extending the length of the station and providing for delivery of steam to the refinery at either end. The boiler feed lines from the pumps to the boilers are in duplicate.

All pipe joints are fusion welded excepting at valves. No. 90 series valves are used on all high pressure steam and water lines and No. 15 series on the low pressure systems. a.s.a. narrow tongue and groove faces are used on the flanged joints.

Switching and Control Equipment

A single electrical bus is provided, divided, however, into three sections, and converted into a ring by oil circuit breakers and a cable tie. The bus potential is to be 2,400 volts. The three bus sections will normally be operated with the bus tie circuit breakers in closed position.

Figure 3 is a one line diagram of the electrical circuits. There are to be initially eight outgoing feeder circuits and two for station auxiliary power and light. These circuits are connected to the bus sections in groups of two and four, each with a generator. Each circuit is provided with a single electrically operated oil circuit breaker, those on the generators rated at 2,000 amperes, and on the feeders at 600 amperes. Current limiting reactors are placed in the generator and station auxiliary circuits. Disconnecting switches on each side provide for cutting out any circuit breaker. Although there is no apparent duplication in the switching layout any generator can feed any section of the bus and interconnection outside in the refinery yard provides a duplicate source of power to all load centers. All feeders generally follow isolated routes to prevent multiple interruptions from common causes. Six of the feeders supply the load directly at 2,400 volts while two are connected to two banks of 23/11 k.v. transformers each consisting of three 750 k.v.-a. single phase transformers connected in delta. These supply an existing 11,000-volt ring encircling the refinery, with stepdown transformers to the 2,300-volt system at important points.

The larger station auxiliary motors are supplied directly at bus voltage, while the smaller units are fed through a 450 k.v.-a. three-phase bank of transformers stepping down to 440 volts. Further stepdown supplies the lighting circuits. The switchboard consists of 13 panels, facing the turbine room. The wiring and connections are accessible from the electrical bay through hinged steel doors. Relays include differential protection for the "Y" connected isolated neutral generator and overload protection for the feeder circuits.

A storage battery and motor generator charger are provided for operation of oil circuit breakers and emergency lights. Figure 4 shows a heat balance diagram of the station with two boilers and two turbine generators operating at their rated capacities. For simplicity idle spare apparatus is not shown. Electrically driven auxiliary equipment is also omitted from the diagram but its power consumption is accounted for in the calculations. The turbine driven boiler feed pump is shown in operation which results in the largest net electric output to the refinery, on the least amount of steam supplied to the refinery at 125 pounds pressure or drawn from it at 12 pounds pressure.

HEAT BALANCE TABLE

Item—	Quantity	Unit	Total
Steam from boilers	250 M/hr.	1,367.5 B.t.u./lb.	341,750,000 B.t.u./hr.
Blowoff from boilers	36 M/hr.	520 B.t.u./lb.	18,720,000 B.t.u./hr.
Total from boilers			360,470,000 B.t.u./hr.
Feed to boilers	286 M/hr.	320 B.t.u./lb.	91,520,000 B.t.u./hr.
Absorbed by boilers		84.00%	268,950,000 B.t.u./hr.
Fired in fuel oil		100.00%	320,180,000 B.t.u./hr.
Losses from boiler		16.00%	51,230,000 B.t.u./hr.
Steam to refinery	192 M/hr.	1,232.5 B.t.u./lb.	236,640,000 B.t.u./hr.
Energy to refinery	7,500 kw.	3,412 B.t.u./kw.-hr.	25,590,000 B.t.u./hr.
Total to refinery			262,230,000 B.t.u./hr.
Steam to power plant	0 M/hr.		0 B.t.u./hr.
Feed to power plant	224 M/hr.	58 B.t.u./lb.	12,990,000 B.t.u./hr.
Supplied by power plant			249,240,000 B.t.u./hr.
Overall plant efficiency		77.84%	
Steam to burners	6 M/hr.	1,232.5 B.t.u./lb.	7,300,000 B.t.u./hr.
Blowoff to waste	26 M/hr.	212 B.t.u./lb.	5,510,000 B.t.u./hr.
Auxiliary electric power	500 kw.	3,412 B.t.u./kw.-hr.	1,710,000 B.t.u./hr.
Auxiliary steam power	515 H.P.	2,543 B.t.u./H.P.-hr.	1,310,000 B.t.u./hr.
Generator inefficiency	200 kw.	3,412 B.t.u./kw.-hr.	680,000 B.t.u./hr.
Miscellaneous radiation and unaccounted		1.06%	3,200,000 B.t.u./hr.
Total nonproductive		6.16%	19,710,000 B.t.u./hr.

Hot Process Heater

Water enters the deaerating hot process heater at the lower right of the diagram, from the cold process water treating plant, having picked up some heat from the generator coolers. It is heated to 220° F. by exhaust from the boiler feed pump turbine, plus flash from the 125-pound heater drips, plus flash from the continuous blow-off from the boilers, plus leakage into the low pressure ends of the turbine, all at about 12 pounds pressure. The water then enters the primary feed pump and passes on through a closed heater to the secondary feed pump. The closed heater draws steam from the 125 pound main and the water is heated to about 348° F. Drips from the heater are partially flashed to the 12 pound steam line and the balance discharged into the feed leaving the hot process softener. The quantity of water entering the softener is thus increased by the weight of steam used for the two stages of heating. The feed water leaves the secondary pump at about 975 pounds pressure and passes directly to the boilers with a tap taken off for desuperheating purposes on the way.

A continuous blow-off is shown from the boilers amounting to approximately 12½ per cent of the total water fed. This is flashed successively at 125 pounds and 12 pounds for the recovery of both heat and water before being discharged to waste.

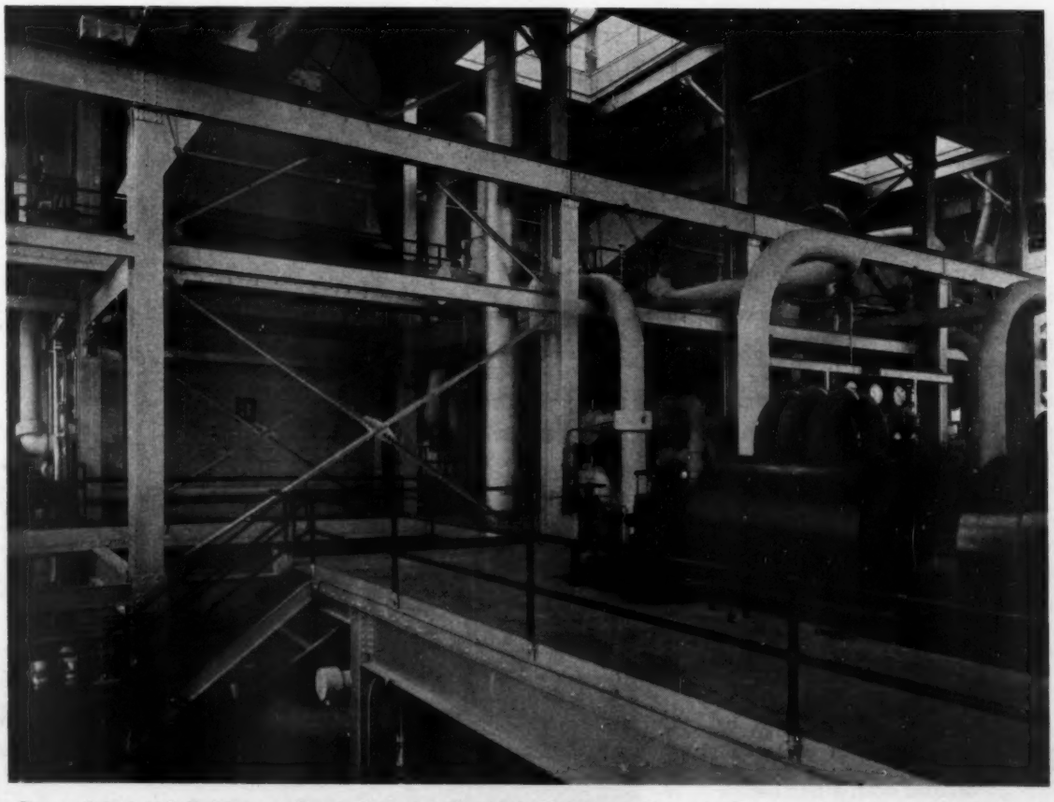
Turbine Load

The boiler output is greater than the steam consumed by the turbines at this load so the excess is by-passed through a reducing, or spillover, valve and desuperheater to the 125-pound main into which the turbines exhaust. This is desirable at present because steam can be generated more efficiently in the new plant than in any of the older ones. If, however, at any time in the future the need of the refinery for steam should be much curtailed, two generators can be operated at full load with only about 150,000 pounds per hour of steam passing to the refinery. The boiler feed pump turbine, the second stage feed water heater, and the steam atomizing burners are supplied from this main. The balance of the 125 pounds steam goes to the refinery.

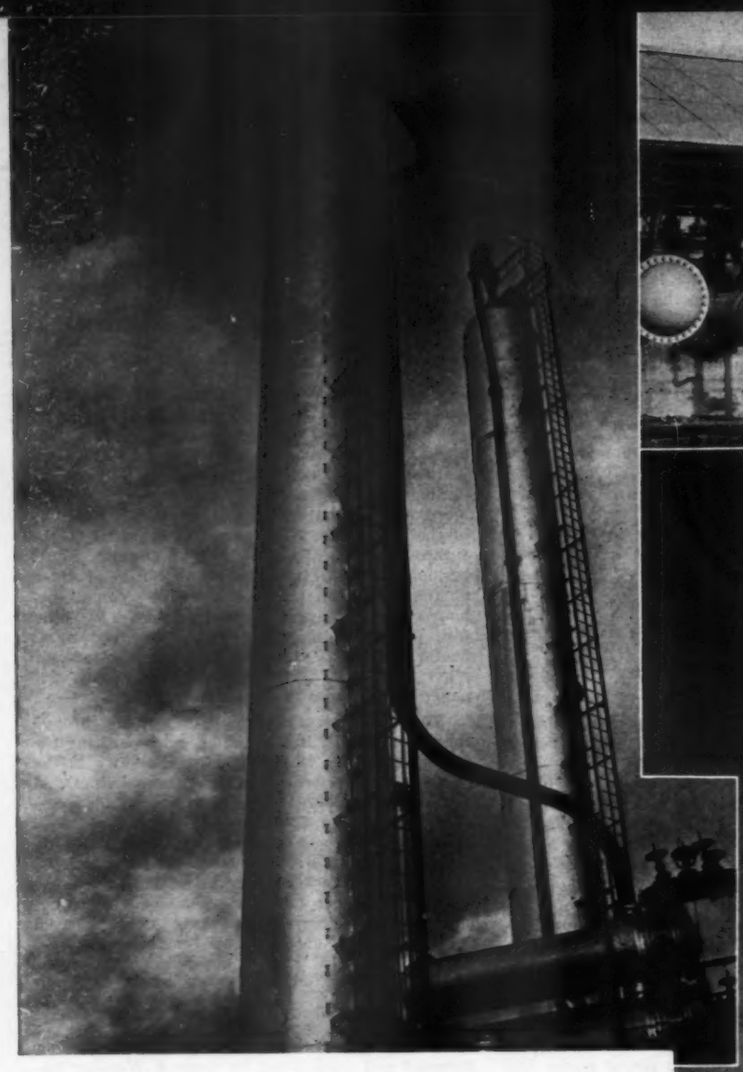
There is a certain amount of leakage through the shaft packing in the diaphragm separating the present from the future exhaust chambers in the turbines. This is vented to the 12-pound lines and any excess or deficiency of steam at this pressure required for first stage heating of the feed in the hot process softener moves to or from the refinery through a balance connection, which on the diagram shows no flow in either direction.

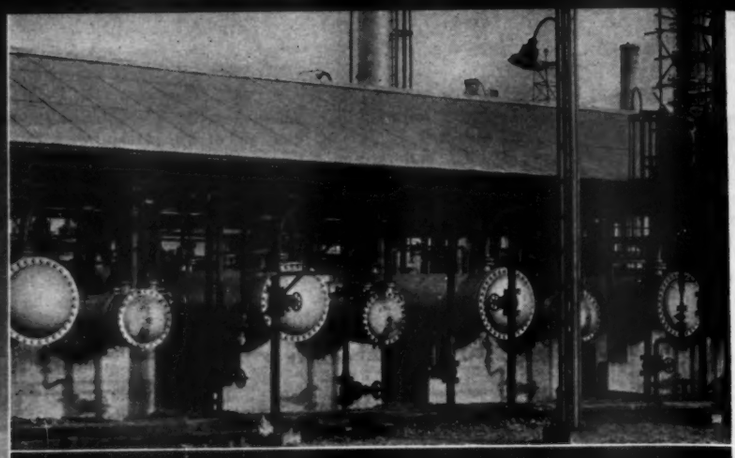
The subjoined table presents some data not shown on the diagram in Figure 4. It is based upon the use of good fuel oil for firing the boilers, and indicates that a consumption of about 52 bbls. per hour will produce 7,500 k.w. net and supply the refinery with 192,000 pounds steam per hour.

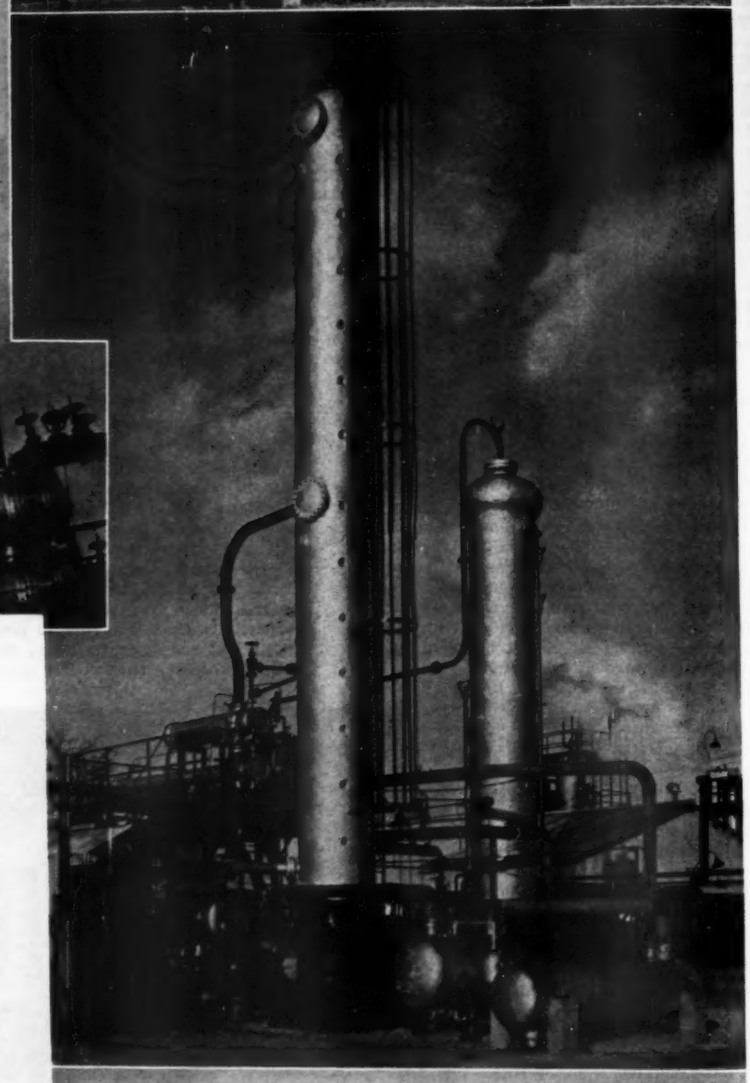
The Richmond refinery power station is being designed and constructed by Stone & Webster Engineering Corp., working closely with the staff of the Standard Oil Co. of California.

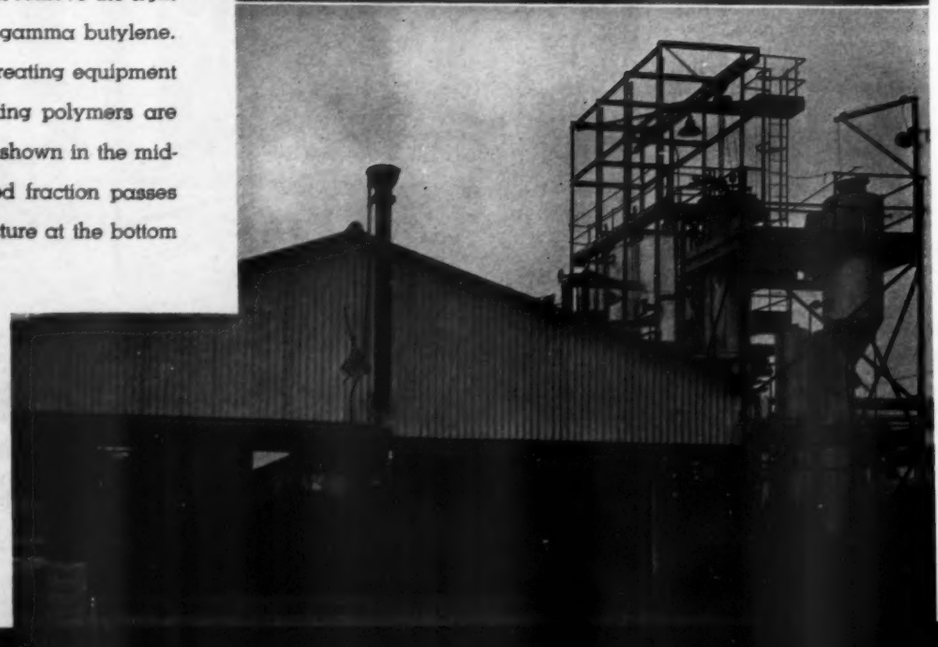


General view showing one floor of power plant in the Texas City plant of the Pan American Refining Co. The three boilers in the background have a rated capacity of 1,100 horsepower each and supply the plant with process steam and electric power through three 2,500 k.w. turbo-generators









To supply a portion of the growing demand for aviation fuels of exceptionally high antiknock value and limited lead content, the Shell Petroleum Corporation recently completed a semicommercial unit at its Houston, Tex., refinery for the production of iso-octane. A similar unit has been constructed by that company at Wood River, Ill. In the pictures included here are shown the most important parts of the Houston installation. At the upper left are shown the superfractionating towers which remove the light liquid fractions which are rich in gamma butylene. This fraction is sulfonated in the treating equipment shown to the right and the resulting polymers are fractionated in the distillation unit shown in the middle picture. From here the desired fraction passes to the equipment shown in the picture at the bottom of the page and here it is hydrogenated to produce commercial iso-octane as a motor fuel of 90 to 96 standard octane number.

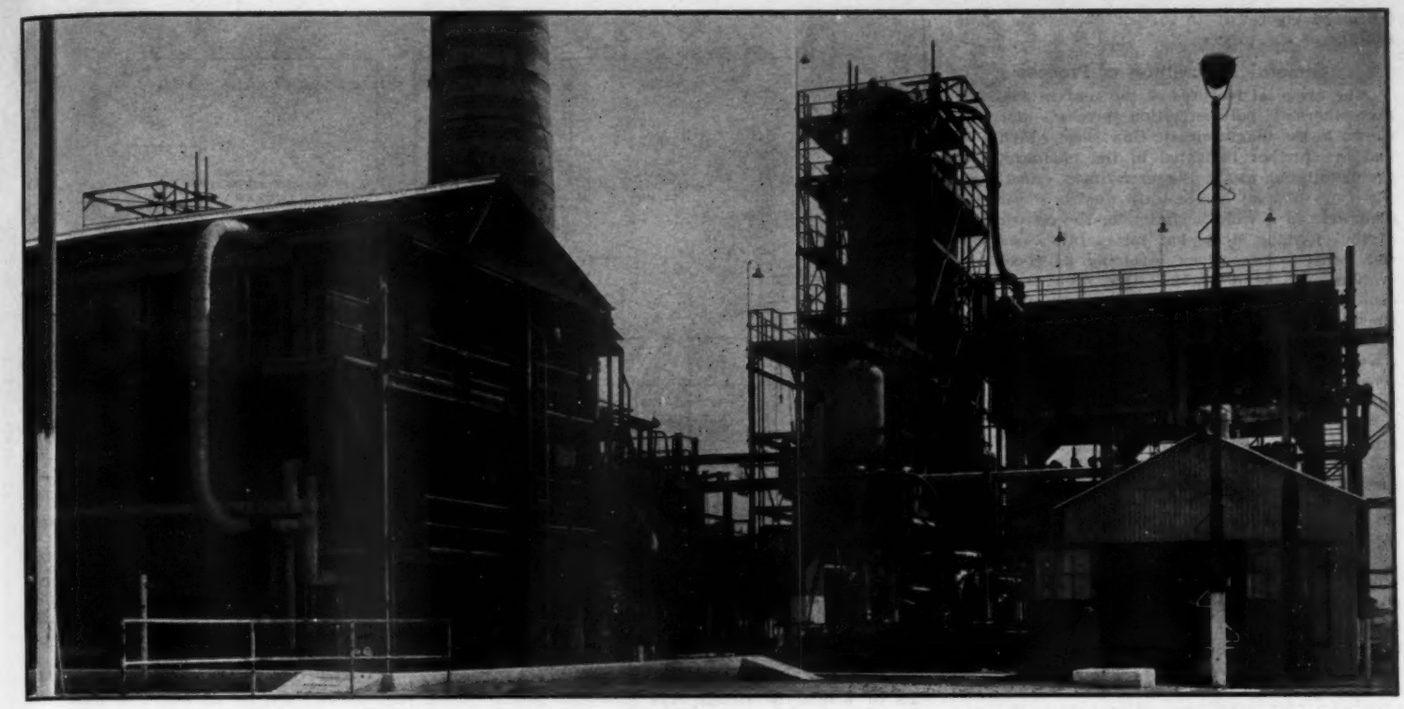


Fig. 2—Thermal polymerization plant in the Borger, Tex., refinery of the Phillips Petroleum Company

Application of Unitary Thermal Polymerization Process

By JOHN T. WARD
Director of Research,
The M. W. Kellogg Co.

The outstanding feature of this process is its wide applicability in converting saturated and unsaturated normally gaseous hydrocarbons to motor fuels by means of heat and pressure. It has many other valuable and several unique properties, predominant among which in importance to refiners is the fact that it is capable of yielding high percentages of product of high volatility and octane blending value.

Recently the results of a very great amount of research and development work on the cracking and polymerization of refinery and natural gases have been published. This work was largely inspired by the economic loss involved in the wastage of natural gas to the atmosphere and by the fact that the potentially valuable constituents of refinery gases were being used for fuel. Due to the extraordinary quantities of natural gas constituents, such as propane, lost in this way, the sums representing the value of the possible product arrived at were staggering and it was obvious that if even a small fraction of the estimated total could be recovered the benefit would be great. Another reason for this development was the desire of petroleum technologists to increase product sales by developing new types of motor fuels which would possess properties that were attractive to the automotive designer, the motor fuel manufacturer and the motorist alike.

The results of this work on the conversion of both natural and refinery gases to motor fuels has indicated that the characteristics of the resulting products were in most respects superior to those which normally are secured when manufacturing gasoline by conventional refinery methods. Consequently it was quickly appreciated that these new fuels had potential possibilities in modifying and probably accelerating the evolution in automotive engine design that gradually is taking place, with resultant improvement in efficiency and performance.

This development and research period has now culminated in extensive commercial application of hydrocarbon gas conversion with consequent widespread interest among refiners. In this connecton, of course, it should be noted that for an extended period of time a full scale thermal polymerization plant has been operating continuously and successfully at the Borger refinery of the Phillips Petroleum Co. At the present time this company is doubling its gas polymerization capacity at Borger, Tex., and is preparing to construct three additional commercial units at other locations. Large units of this type will also be installed shortly for the Atlantic Refining Co. and the Humble Oil & Refining Co.

The process here considered, and designated as the unitary thermal process, is licensed by the Polymerization Process Corp., through its licensing agent The M. W. Kellogg Co., under the patents applying to this process of the Phillips Petroleum Co., the Standard Oil Co. (Indiana), Standard Oil Co. of New Jersey, The Texas Co., and The M. W. Kellogg Co. The plants utilizing this process are constructed by The M. W. Kellogg Co. The unitary thermal process possesses a number of distinctive and commercially valuable characteristics:

(1) Wide applicability to both saturated and unsaturated charging stocks.

(2) High yield of product.

(3) Flexibility in operating conditions.

(4) Facility in varying the characteristics of the product.

(5) Simplicity—in that equipment required is similar in construction to cracking equipment now in general use.

(6) Adaptability as a component part of single or combination crude and cracking units.

This process is capable of successfully employing as charging stock the hydrocarbons as found in natural or refinery gases, varying from pure propane and butane, and mixtures thereof as such, or with ethane, or with their respective unsaturates, to the complex mixtures found in stabilizer reflux and absorber oil distillates. Separation of saturates from unsaturates is normally not required but may be practiced for special purposes. The unitary thermal process is adaptable either to isolated operaton as a separate unit or in combination with black oil and gas oil cracking, naphtha reforming units and natural gasoline recovery plants. Certain of the basic data from both the development and commercial units and the process steps known or understood to be concerned with this development were presented in outline at the November, 1935, meeting of the American Petroleum Institute, at Los Angeles.[1] It was also pointed out in this paper that the unitary thermal process resulted from cooperative research and development on the part of the five companies mentioned above, associated in the Polymerization Process Corp., which work is being

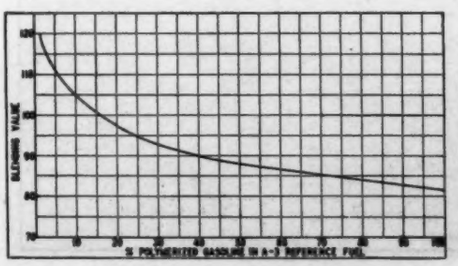


Fig. 4—Blending values of gasoline

[1] "The Thermal Conversion of Hydrocarbon Gases to Gasoline," by P. C. Keith, Jr. and J. T. Ward.

continued vigorously to further extend the applicability of the process.

General Description of Process

The essential features of the conventional unitary thermal polymerization process unit are shown in the diagrammatic flow sheet (Figure 1) and are further indicated in the photograph of the installation at the Borger refinery (Figure 2). The type of plant herein illustrated is thoroughly adaptable to a wide variation in the constitution of the charging stock, but for certain cases certain other combinations involving multi-coil operation may be desirable. One such possibility could consist of a two-stage process in which the charge would be first subjected to polymerization conditions, followed by separation of liquids, and a second stage consisting of substantially a unitary process for converting the residue. Another alternative, perhaps more applicable to certain natural gasoline residue feed stocks, would be moderate pressure, high temperature cracking of the feed followed by high pressure polymerization with separation of liquids, succeeded by a unitary thermal operation.

The normal operating conditions of the plant illustrated above consist of a recycling process in which the reaction coil operates at from 800 to 2,200 pounds pressure and at temperatures varying from 900° to 1,075° F. The entire plant may be considered to consist of two principal parts: the polymerization unit proper and the gas and cycle stock recovery system. As has been indicated, the polymerization portion of the unit will usually vary with feed stock composition only to the extent of arrangement of reaction coil surface. On the other hand, the precise type of gas and cycle stock recovery system to operate at lowest overall cost is quite dependent on feed composition and therefore may vary considerably as to type and operating conditions with this factor. Aside from this element the equipment used in this polymerization plant partakes of the general characteristics of conventional coil type cracking plant equipment, both as to reaction surface, materials of construction, instruments, pumps, exchangers, etc. From heat and material balances the fuel consumption will vary between 6 and 10 per cent of the fresh feed stock charged.

The yield of product will naturally vary with the composition of the feed stock. In the product yields reported below the values are quoted on a "net" basis due to the fact that for local reasons the fractionating systems of both the commercial and the development plants have not been operated to afford perfect separation of C_3 and C_4 constituents, and therefore an absolutely true recycling operation did not obtain. Gas analyses of the off gas stream and the cycle stock, however, afforded an opportunity to eliminate variations in the observed yields by calculating them to a net basis, which is defined as the yield realized based on the C_3 and C_4 fractions disappearing. The results of a series of four pilot plant runs in which the charge was stabilizer reflux may be taken as representative of these conditions are given in Table 1.

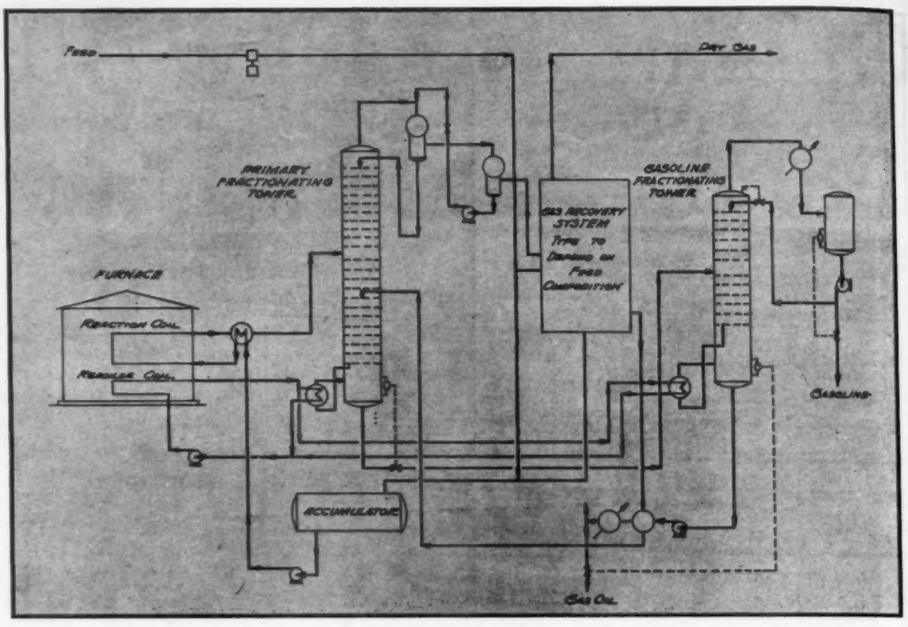


Fig. 1—Diagrammatic flow sheet of Polymerization Process Corporation unit

TABLE 1—RECYCLNG OPERATION

Run No.:	772	861	903	942
Pressure, lbs. per sq. in...	800	1,200	1,200	1,200
Temperature, deg. F.	1,000	1,000	1,100	1,020
"Net" yield, per ct. by wt.	67.9	69.0	69.6	64.5
Weight, per cent of saturates in feed (net)	57.0	54.0	60.7	59.9
Weight, per cent of unsaturates in feed (net) ...	43.0	46.0	39.3	40.1
Net yield as per cent of unsaturates in fresh feed	158	150	177	161
Gallons of liquid per 1,000 cu. ft. net gaseous feed.	12.78	13.10	14.40	13.5
Gross feed, per cent by volume:				
C_3H_6	3.4	1.9	2.4	2.0
C_3H_8	12.2	6.8	9.6	6.5
C_4H_8	29.6	30.5	21.3	21.0
C_4H_{10}	46.3	49.8	38.8	39.6
C_5H_{10}	4.3	4.8	11.0	13.6
C_5H_{12}	4.2	6.2	16.9	17.3
Net feed, per cent by weight:				
C_3H_6	43.0	41.1	23.1	20.3
C_3H_8	57.0	54.0	36.4	37.1
C_4H_8	....	4.9	16.1	19.8
C_4H_{10}	....	....	24.3	22.8
Blending value of 400 endpoint distillate, 50 per cent in "A" reference fuel, octane number, C.F.R.M.	92	90	88	89

Comparable data when charging a mixture of 60 per cent propane and 40 per cent normal butane indicates in general what may be expected from feed stocks solely of natural gas origin, as shown in Table 2.

TABLE 2—PILOT PLANT RECYCLING OPERATION

Pressure, lbs. per sq. in.	1,200
Temperature, degrees F.	1,035
Feed composition, per cent by weight:	
C_3H_8	58.2
C_4H_{10} (net)	41.2
Liquid yield (net), per cent by weight.....	59.0

	Raw Product	Rerun Product
Gravity, degrees A.P.I.	65.2	64.6
ASTM Distillation in Degrees F.		
Initial boiling point	97	112
5 per cent point	116	133
10 per cent point	122	137
20 per cent point	132	145
30 per cent point	142	156
40 per cent point	154	164
50 per cent point	168	174
60 per cent point	183	187
70 per cent point	206	203
80 per cent point	239	231
90 per cent point	325	281
95 per cent point	420	306
Endpoint	456	379
C.F.R. motor method, octane number*	89	93
Reid vapor pressure	10.2	10.0

*Blending value, 50 per cent in A-3 reference fuel.

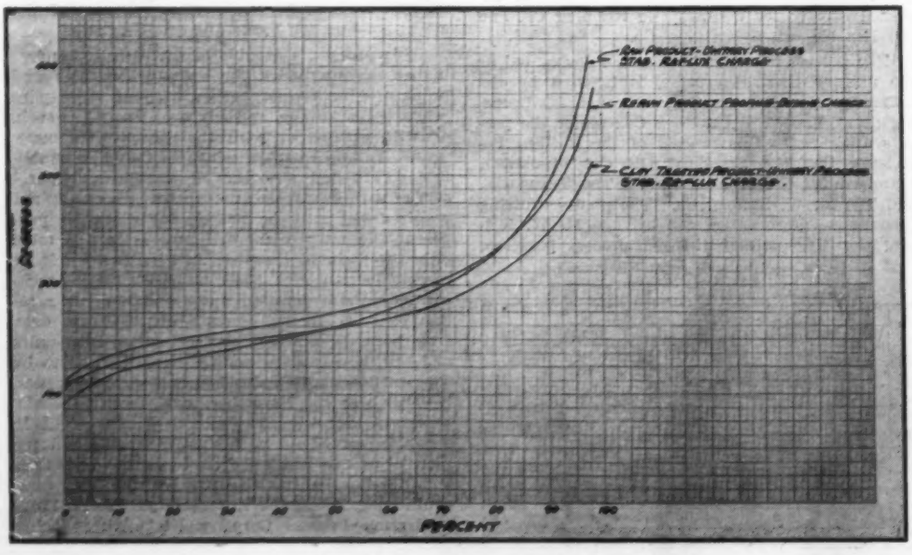


Fig. 3—Distillation range of typical products

The commercial installation at Borger is adaptable to handling a wide range of feed stocks, but in most of the runs mixtures of natural and refinery gases have been processed and these have largely been high in butane content. Due to local conditions complete recycling has not been practiced. The operating conditions have ranged from 980° to 1,075° F. and 1,600 to 2,000 pounds pressure. The net yields of polymerized product have ranged from 60 to over 80 per cent by weight, depending on feed stock conversion per pass and other operating variables. The operating schedule between cleanouts has varied from 50 to 60 days The operation of the Borger unit has been completely successful as to capacity, mechanical performance and quality and yield of product.

Characteristics of Product

The distillation range and blending values of typical product are given in Figures 3 and 4, respectively. Variations in other characteristics appear to be primarily functions of feed stock composition and operating conditions. Where the feed stock is high in unsaturates (65-70 per cent by volume) and the conversion per pass is high the product liquid is lower in gravity and paraffin content than the polymer product where the unsaturates are in the range between 15 and 35 volume per cent.

The material resulting from unitary thermal process operation on stabilizer reflux containing 30-38 per cent by volume of unsaturates will have an A.P.I. gravity of 60 to 64 degrees when stabi-

(Continued on Page 148)

Operation of New Atlas Thermal Polymerization Unit Described

Considerable interest has been shown over the announcement of E. R. Ratcliff, president of Spartan Oil Corp, of Shreveport, La., who announced on January 1, 1936, that there had been a merger of Spartan Oil Corp., Spartan Refining Co., Inc., and Atlas Pipe Line Co., Inc. The new corporation is now the Atlas Oil Corp. The interesting feature of the announcement of Mr. Ratcliff is the fact that this reorganization puts into operation again the largest polymerization plant so far built and operated.

Pure Oil Company's thermal polymerization unit operating in its Toledo, Ohio, refinery

Two Gyro Units

Spartan Refining Co. (now Atlas) purchased two large Gyro cracking units from Alco Products, Inc., in 1933 and the large polymerization plant. Due to reorganization changes, the plant has only recently resumed normal operation. It is of interest to the refining fraternity in general to learn more details of the pioneering spirit manifested by this relatively small independent refining company. Atlas pioneered the commercial production of high octane motor fuels by means of polymerization instead of depending upon tetraethyl lead. The poly plant at Shreveport is operated under license of the Pure Oil Co., and is of the thermal type; no catalysts are used. While the Pure Oil Co. operated a large semi-commercial plant at Toledo, Ohio, for several years, the Atlas Installation represents the largest unit contracted for by other refiners. The past year has witnessed a great rise in interest in this new development, which is probably one of the greatest developments witnessed by the refining industry in several years. This poly unit was added by the Atlas company because of the availability of highly unsaturated gases from its Gyro units. Some 5,000,000 feet of Gyro gas is evolved per day and its unsaturation is about 60 per cent. This gas is ideal for polymerization charge stock and is readily converted to high octane gasoline by the Alco-Pure Oil thermal process of polymerization. From 500 to 1,000 bbls. of poly gasoline can be made in this plant per day. The flow of the charge stock through the system should be of interest and is as follows:

The gas plant at the Atlas plant delivers the dry Gyro gas to a cooler and condenser which, in turn, delivers the liquefied charge to an accumulator tank held under pressure. This tank vents any unliquefied gases to the absorption plant from which the methane and other light gases are discharged to the plant fuel gas line. A pump takes suction from the accumulator tank, which also receives the recycle, and delivers the liquefied charge through heat exchangers to the main heating coil of the furnace. The charge is rapidly heated to reaction temperature and is then passed to a reaction zone where polymerization of the unsaturates and saturates takes place under carefully controlled time and temperature conditions. At the end of the coil the reacting gases are suddenly chilled and the chilled mixture enters the fractionating tower at a reduced temperature so that the polymerization reaction will not be carried too far. The polymerized gasoline is condensed and pumped to a stabilizer whence the stabilized poly gasoline is removed from the bottom. The uncondensed lighter constituents are sent to the absorber and the rich oil is returned to the main fractionating tower for recovery of the condensable gasoline.

At the present time the stabilized poly gasoline is blended with Gyro stock to make a very volatile 400° endpoint antiknock gasoline. The octane of the mixture ranges from 68 to 70 (A.S.T.M.). This poly gasoline is valuable as a blending agent for straightrun gasoline and will no doubt be used for such purposes. The average octane of all gasoline sold in the United States is 66 A.S.T.M., including premium priced leaded gasolines, benzol blends, etc. The general adoption of polymerization by refiners will make it possible to raise the average for the whole country by three to five octane numbers. When it is realized that power output from an engine rises abnormally as the octane number of the gasoline is increased, the potentialities of polymerization can be more easily visualized.

Stabilized Gasoline

Several plants of this type have been designed and they will operate on a variety of charging stocks, producing polymerized gasolines with octane ratings from 80 to 100 (A.S.T.M.).

It is opportune to remark that polymerization does not waste gas; it conserves it. In contrast to carbon black plants, where less than 2 per cent of the value of the gas from a thermal standpoint is utilized and 98 per cent lost as heat to the atmosphere, polymerization extracts only useful products and conserves all the remaining gas for other uses. Data are now available which indicate that in the near future the residue gases issuing from a polymerization plant will be used as a source of hydrogen and also as a source of alcohols. The economics of such a combination vary from month to month, but it is safe to assume that a variety of chemicals will eventually be made from refinery gases in conjunction with polymerization plants.

Pump house as part of the Shell Oil Co.'s iso-octane plant in the Wood River, Ill., refinery

Catalytic Production of POLYMER GASOLINE

By GUSTAV EGLOFF
Director of Research, Universal Oil Products Co.

The desire for increased speed combined with greater efficiency in motor cars and airplanes has led to great improvement in motor design and gasoline. Since motor design has been dependent to a great extent upon the type of fuel available, the gasoline manufacturer has met the demand of the automotive engineer by producing a high antiknock gasoline capable of yielding the power and miles per gallon for which the engines were designed. Motor efficiency is dependent in part upon the compression ratio of the engine, which in turn rests upon the octane rating of the fuel used. In the past year or so the oil industry has marketed a fuel of 100 octane capable of operating very high compression motors.

The catalytic production of gasoline from hydrocarbon gases in the U. S. have made potentially available 9,000,000,000 gallons of motor fuel, having an octane number of 80-83, 1,000,000,000 or more of which can be converted into 100-octane gasoline.

Catalytic polymerization[1] is a process whereby cracked or dehydrogenated hydrocarbon gases are subjected to mild heat and pressure while flowing over a solid catalyst. The process operates upon the olefins present in the gas, producing a controlled liquid product boiling within the gasoline range. The gasoline formed is made up of relatively few hydrocarbons. The catalytic process so controls the polymerization reaction that but few hydrocarbons are produced as gasoline. The oil industry is in a position to furnish gasoline with but practically one type liquid hydrocarbon such as olefins that boil in the gasoline range, thus making it possible to have a more uniform and better controlled combustion in the cylinders of automotive engines.

The hydrocarbon gases as they flow from the gasoline receiver drum, stabilizer tops or stabilizer reflux of cracking installations or from a hydrocarbon gas cracking unit or catalytic dehydrogenation unit are led to a pipe coil heater where a temperature of about 400° F. and a pressure of 200 pounds per square inch is maintained. The gas flows from the heater into the top of the "solid phosphoric acid" catalyst chamber, out at the bottom of the chamber, and thence to other catalytic towers in a similar manner to that of the first. A temperature rise of about 100° F. occurs in the catalyst bed due to the exothermic character of the polymerization reaction. The polymer vapors pass through a cooling coil into a receiver. The gasoline is then stabilized in order to produce the desired vapor pressure.

TABLE 1—HIGH SULFUR POLYMER GASOLINE

	Sweet
Gravity, °A.P.I.	64.1
Doctor	Neg.
Gum, A.S.T.M.	5
A.S.T.M. 100 cc. Distillation Test	
	°F.
Init. B.P.	126
Per cent distilled over:	
10	177
20	194
50	225
90	327
Endpoint	418
Octane number (C.F.R. motor method)	80.0
Sulfur, per cent	0.38
Oxygen bomb stability:	
Induction period in minutes, original	40
Original + 0.01 per cent inhibitor	200
Octane blending value	117

TABLE 2—LOW SULFUR POLYMER GASOLINE

	Sweet
Gravity, °A.P.I.	65.4
Doctor	Neg.
Gum, A.S.T.M.	2
A.S.T.M. 100 cc. Distillation Test	
	°F.
Init. B.P.	114
Per cent distilled over:	
10	169
20	190
50	218
90	320
Endpoint	418
Octane number	82.5
Sulfur, per cent	0.04
Oxygen bomb stability:	
Induction period in minutes, original	40
Original + 0.01 per cent inhibitor	300
Octane blending value	122

The gases originally present are made up of olefins and paraffins. The olefins on treatment are converted to liquid polymers substantially of the mono-olefin type. The remaining paraffinic gases may then be catalytically dehydrogenated into over 90 per cent of propene and butenes. These olefins are then subjected to the catalytic polymerization reaction outlined. Over 75 per cent by weight of the original gaseous hydrocarbons can be converted into gasoline of 81-83 octane number. Or based upon a 50 per cent each propane-butane mixture, the volume yield is over 19 gallons of gasoline per 1,000 cubic feet.

A flow chart showing the polymerization by catalytic action is given in Figure 1.

When the concentration of hydrogen sulfide is relatively high in the gases to be processed catalytically, a portion of the hydrogen sulfide reacts with the olefins to produce mercaptans which appear in the polymer gasoline. The hydrogen sulfide present does not affect the catalytic properties of the "solid phosphoric acid" used in the polymerization process. This process may be a commercial source of producing mercaptans when desired. In the event it is desirable to "de-H_2S" the gas, several commercial processes are available such as tri-potassium phosphate, sodium carbonate, sodium phenolate, diaminopropanol, triethanolamine, and mixtures of mono-, di-, and triethanolamine. The percentage of sulfur present in the gasoline can be readily controlled as a function of the hydrogen sulfide removal.

Two types of polymerized gasoline are produced from high and low sulfur containing hydrocarbon gases. The "high sulfur" gasoline contains 0.47 per cent sulfur and the "low sulfur" contains 0.03 per cent sulfur.

The properties of both as gasolines are given in Tables 1 and 2.

Common types of gases used in polymerization are cracking still receiver gas, stabilizer reflux, and stabilizer gas. A typical receiver gas used in the process was derived from the liquid-vapor phase cracking of a mixture of Mid-Continent and West Texas topped crude. The gas was condensed under 75 pounds per square inch pressure, the cracking conditions producing the gas were 932° F. and 200 pounds per square inch pressure.

The stabilizer reflux was derived from the fractionation under pressure of cracked distillate. The stabilizing tower was operated at a top temperature of 131° F. and a pressure of 180 pounds. This treatment gives the required vapor pressure to the gasoline which in this case was 10

View of Universal Oil Products Company catalytic polymerization process with Dubbs cracking units shown in the background. These are located near Chicago

[1] Ipatieff, Corson, and Egloff, Ind. and Eng. Chem., 27, 1,077, 1935; Ipatieff and Egloff, Nat. Pet. News, 27, No. 20, 24G-24M (1935); The Oil and Gas Journal, 23, No. 52, 31-32, 99 (1935); Egloff, Nat. Pet. News, 27, No. 47, 65-72 (1935).

pounds Reid vapor pressure. The temperature control on the top of the stabilizer was maintained by pumping back reflux liquid. The stabilizer reflux which is liquid under the conditions of the stabilizer tower, is a gas at atmospheric pressure.

The stabilizer gas was obtained from the top of the fractionating column used in the stabilization of gasoline produced by vapor-phase cracking of gas oil subjected to 1,022° F. and atmospheric pressure. The gasoline was stabilized at 140° F. and 200 pounds pressure.

The following analytical data are average for these types of gases. In Tables 3, 4 and 5 are given gas analyses, run data, and properties of the polymer gasolines produced.

TABLE 3—GAS ANALYSIS OF ORIGINAL CHARGE TYPICAL PERCENTAGE ANALYSES

Constituents—	Receiver gas	Stabilizer reflux	Stabilizer gas
Hydrogen	4.3	0.1	0.6
Methane	22.2	0.1	3.4
Ethylene	6.0	0.6	16.0
Ethane	17.3	3.2	17.8
Propene	11.2	16.2	29.0
Propane	26.8	16.8	22.2
Butenes	4.0	20.4	4.9
Butadiene	...	....	3.3
Butane	5.6	40.5	2 0
Pentane	0.2	1.2	0.2
Carbon monoxide + N_2	1.6	(N_2) 0.5	(N_2) 0.4
Hydrogen sulfide	0 8	....	0.2

TABLE 4—RUN DATA

	Receiver gas	Stabilizer reflux	Stabilizer gas
Operating conditions:			
Hours on test	120	72	72
Gauge pressure, lbs./sq. in.	200	100	100
Temp., deg. F.	450	400	450
Olefin content of gas:			
Propene and butenes, %	16.8	37.5	42.7
Ethylene, %	7.0	....	21.2
Olefin polymerization:			
Propene and butenes, %	95	89	96
Ethylene, %	31	....	32
Gal./1,000 cu. ft. of gas:			
Liquid polymer	4.0	7.2	5.4
Gasoline	3.7	6.5	7.0

TABLE 5—POLYMER GASOLINE PROPERTIES STEAM DISTILLATION

	Receiver gas	Stabilizer reflux	Stabilizer gas
Gr., deg. A.P.I. at 60° F.	61.8	62.8	60.2
Sp. gr. at 60° F.	0.732	0.728	0.738
Color, deg. Saybolt	30	30+	25
Color stability	22	21	19
Gum (Cu dish), mg./100 cc.	5	4	72
Sulfur, %	0.4	0.16	0.04
Oxygen bomb:			
Induction period, min.—original.	40	40	55
Original + 0.025% wood dist. inhibitor	275	275	610
Octane No. (C.F.R. Motor Method)	82	82	82
Octane blending value (25% in Fuel A-3, C.F.R. Motor Method)	120	121	116
Reid vapor pressure at 100° F., lb.	5.0	5.0	5.2
100 cc. A.S.T.M. Distillation			
Initial boiling point, deg. F.	134	150	142
Per cent distilled over, deg. F.:			
5	180	177	178
10	194	192	194
20	212	203	216
30	225	211	234
40	237	218	251
50	248	225	266
60	261	239	284
70	280	258	304
80	303	285	324
90	337	326	360
Endpoint	401	389	414

Time Factor

The time factor in the catalytic polymerization process, at constant temperature and pressure influences the boiling range of the polymer liquid. The polymer distillation range can be readily controlled so as to boil within gasoline range. The octane rating of the liquid polymer is not materially affected, whether the boiling range increases from 411° F. endpoint to 531° F. endpoint.

The effect of the time factor in the polymerization of a stabilizer gas containing an average of 36 per cent propene and butenes, with operating conditions, yields, and quality of products is shown in Table 6.

TABLE 6—EFFECT OF THE TIME FACTOR ON STABILIZER GAS*

Operating conditions:				
Hours on test	42	48	48	48
Contact time (seconds)	24	42	85	173
Temp., °F.	450	450	450	450
Pressure per sq. in.	155	155	155	100
Per cent polymerization of propene-butenes	79	87	92	99
Polymer liquid, gals./1,000 cu. ft.	5.6	6.6	7.4	8.4
Polymer liquid:				
Gravity, °A.P.I. at 60° F.	66.6	67.8	66.4	62.7
Sulfur, per cent	0.31	0.32	0.23	0.12
Octane No. (C.F.R. M. M.)	81	82	80	81
Reid vapor pressure at 100° F., lbs.	12 5	14.0	13.9	14.0
100 cc. A.S.T.M. Distillation	°F.	°F.	°F.	°F.
Init. B.P.	104	84	89	95
Per cent distilled over:				
10	166	148	164	158
20	189	182	194	188
30	199	196	209	210
40	206	211	221	235
50	214	222	234	258
60	225	238	254	292
70	244	262	290	327
80	293	310	328	372
90	352	372	420	460
Endpoint	411	413	439	531

*Ipatieff and Egloff, The Oil and Gas Journal, May 16 (1935).

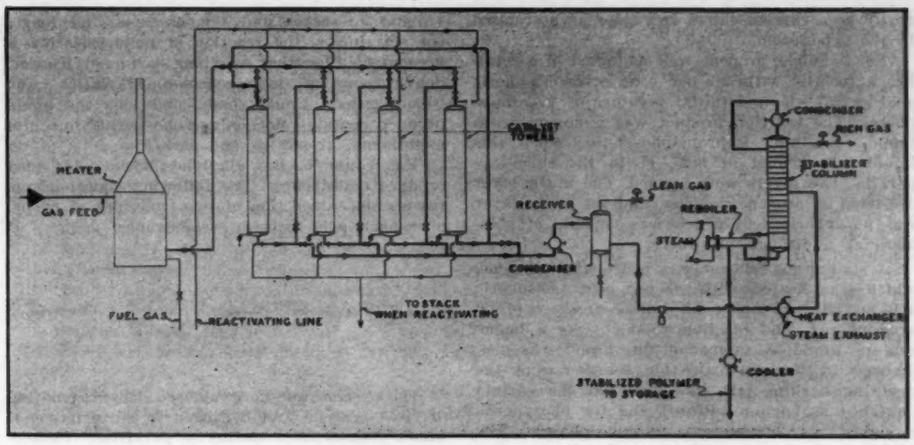


Fig. 1—Flow chart of catalytic process of polymerizing cracked or dehydrogenated hydrocarbon gases by subjecting them to heat and pressure while flowing over a solid catalyst

The outstanding characteristic of polymer gasoline is its high octane number and blending value. The distillation range can vary considerably without affecting its antiknock properties. Polymer gasoline has higher blending value than either benzol or iso-octane, although its straight octane value is lower, i.e., 80-83 as compared to 97 and 100 respectively. The blending value becomes higher, the lower the octane number of the base fuel with which it is blended. The data are shown in Table 7.

TABLE 7—OCTANE BLENDING VALUE OF POLYMER, BENZOL AND ISO-OCTANE GASOLINE

A. Octane Numbers

Polymer gasoline	81
Benzol	97
Iso-octane	100

B. Polymer Gasoline Blends

Polymer gasoline in blend, per cent	5	10	15	20	25
Octane blending value, base gasoline:					
45 octane number	125	125	121	120	117
55 octane number	125	120	115	113	111
65 octane number	105	105	105	105	103

C. Benzol Blends

Benzol in blend, per cent	5	10	15	20	25
Octane blending value, base gasoline:					
45 octane number	84	85	84	84	86
55 octane number	84	85	88	90	89
65 octane number	84	85	88	90	91

D. Iso-octane Blends

Iso-octane in blend, per cent	5	10	15	20	25
Octane blending value, base gasoline:					
45 octane number	94	94	94	96	96
55 octane number	94	94	95	98	99
65 octane number	94	94	95	97	97

Iso-Octane Motor Fuel

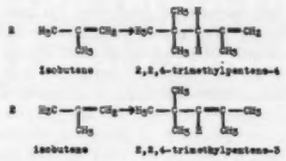
By "selective" catalytic polymerization of the isobutene present in the "butanes-butenes" fraction from the cracking still stabilizer and mildly hydrogenating the iso octenes a 95-100 octane gasoline may be produced.

Analyses of stabilizer butanes-butenes derived from cracking different stocks are shown in Table 8.

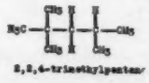
TABLE 8—BUTANES-BUTENES FROM STABILIZER

	Per cent					
n- and i-Butane	68 4	61.9	57.9	51 9	58.9	52.4
n-Butenes	19.3	22.1	23.1	24.0	28.7	36.1
i-Butene	8.9	16.0	19.0	20.0	12.4	11.5

The products are not only di-isobutenes by polymerization but also the tri-isobutenes. The reactions are expressed graphically, showing the di-isobutene and hydrogenated product.



A mixture of 2,2,4-trimethylpentene-4 and 2,2,4-trimethylpentene-3 is known technically as "di-isobutene." The octane rating of "di-isobutene" by the C.F.R. motor method is 84 but on a blending-value basis in Reference Fuel A-3 it ranges up to 153 octane number, depending on the concentration used. Upon hydrogenation, the two trimethylpentenes comprising di-isobutene form the same iso-octane (2,2,4-trimethylpentane) of 95-100 octane number represented by formula as follows:



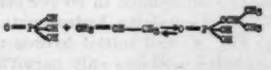
Over 1,000,000,000 gallons of 95-100 octane motor fuel can be produced yearly in the United States from the present hydrocarbon gases available, and this volume can be increased markedly whenever the economic demand is there.

Mechanism of Olefin Polymerization in the Presence of Phosphoric Acid Catalyst

From the chemical standpoint, the proposed mechanisms of catalytic polymerization are indicative of what occurs during the treatment of olefin containing gases.

The catalytic action of phosphoric acid[1] is based on its ability to form esters with olefins. The ester molecules are assumed to react with each other to produce polymer and regenerate phosphoric acid or to liberate activated olefin molecules which react with molecules of ester or other molecules of olefin to produce polymers and regenerate phosphoric acid.

Experiments have shown that olefins react with phosphoric acid at relatively low temperatures (392° F. for ethylene, 257° F. for propene) to form esters:



These esters have been isolated and subsequently converted into polymer and phosphoric acid; that is, the polymerization process has ac-

[1]Ipatieff, Ind. Eng. Chem., 27, 1,067 (1935).

tually been carried out in two steps as postulated by the hypothesis.

For example, propene was contacted in a rotating autoclave with 90 per cent orthophosphoric acid at 257° F. and initial pressure of 10 atmospheres. The reaction product was a homogeneous liquid containing isopropylphosphate. When this liquid was heated at 302° F. in the same apparatus, two layers were formed. The upper layer consisted of propene polymer, and the lower layer was phosphoric acid which was capable of polymerizing additional propene.

A similar experiment was made with ethylene, which was heated with 90 per cent phosphoric acid at 392° F. under an initial pressure of 60 atmospheres. The reaction product was a homogeneous liquid. A sample of this liquid was neutralized by barium hydroxide solution, and the resulting barium salt was analyzed for barium (weighed as barium sulfate) and for phosphorus (weighed as magnesium pyrophosphate). The analytical figures agreed fairly well with those for the barium salt of mono-ethyl phosphoric acid.

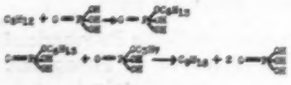
Analysis. Calculated for $C_2H_5BaPO_4$: Barium, 52.5; phosphorus, 11.9. Found: Barium, 53.3; phosphorus, 12.1.

When the ester was heated in the same apparatus at 630° F., two layers were formed, an upper polymer layer and a lower phosphoric acid layer.

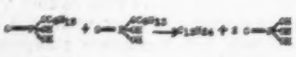
At the temperatures employed in polymerization, the life of these esters is probably very short. A single molecule of phosphoric acid should be able to bring about the polymerization of many molecules of olefin since the acid is regenerated after each cycle. In one experiment on the polymerization of propene, the quantity of polymer obtained corresponded to the polymerization of 110 molecules of propene by a single molecule of phosphoric acid, and at the end of the experiment the acid was as active as it was at the beginning.

The following equation represents the decomposition of 2 molecules of isopropyl phosphoric acid with the formation of 1 molecule of hexylene and the regeneration of 2 molecules of phosphoric acid:

The esters may eliminate the elements of phosphoric acid in different ways, thus giving rise to isomeric polymers. The first formed hexylene may react with phosphoric acid to form hexyl phosphoric acid which in turn may react with propyl phosphoric acid to produce nonylene.



In the same way, nonyl phosphoric acid may react with propyl phosphoric acid to form dodecylene, or two molecules of hexyl phosphoric acid may produce dodecylene.

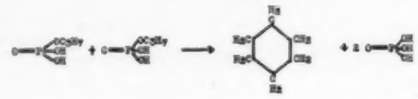


Under moderate polymerizing conditions, 275° to 302° F. at 1 to 15 atmospheres pressure, propene polymerizes to a liquid consisting almost entirely of mono-olefins, presumably of branched structure. The liquid polymer distills from 104° to 446° F. with very little bottoms.

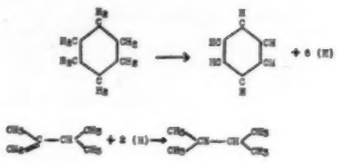
The evidence for the chemical nature of this polymer product is four-fold. The polymer is practically 100 per cent soluble in 96 per cent sulfuric acid at 32° F.; catalytic hydrogenation of the polymer at 428° F. and initial hydrogen pressure of 96 atmospheres produces only paraffinic hydrocarbons, which indicates the absence of naphthenes and aromatics; the bromine number of the polymer agrees with that calculated for mono-olefins; the carbon-hydrogen ratio corresponds to C_nH_{2n}.

Under more severe polymerizing conditions (higher pressures and temperatures and longer contact times), the reaction of polymerization is accompanied by other reactions such as cyclization, dehydrogenation, hydrogenation, alkylation, and isomerization. Under these conditions the liquid product contains not only mono-olefins but also naphthenes, aromatics, and paraffins.

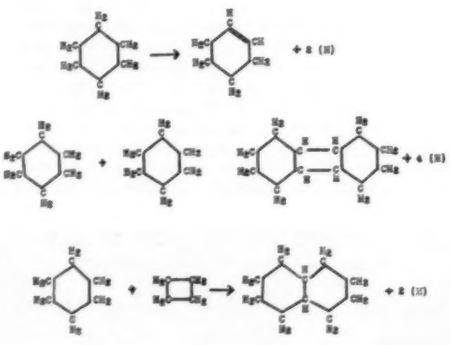
For example, the alkylphosphoric acids may produce naphthenes. The following equation represents the interaction of two molecules of propyl phosphoric acid to form cyclohexane:



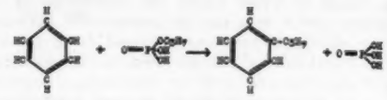
The cyclohexane may undergo dehydrogenation to yield benzene and hydrogen in statu nascendi which hydrogenates olefins to paraffins. (Molecular hydrogen under the experimental conditions cannot hydrogenate olefins.) Thus the dehydrogenation of naphthenes and the hydrogenation of olefins takes place simultaneously. The following equations represent the simultaneous dehydrogenation of cyclohexane to benzene and the hydrogenation of hexylene to hexane.



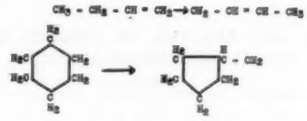
Also naphthenes can undergo partial dehydrogenation with the formation of unsaturated naphthenes and also polynuclear naphthenes:



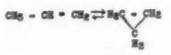
The aromatics can be alkylated by alkyl phosphoric esters to form such compounds as isopropylbenzene:



Various types of isomerization can take place. Double bonds or groups can wander, as illustrated in the shift of α-butene into β-butene or of cyclohexane into methyl cyclopentane:



Also, open chain olefins can isomerize into naphthenes, and vice versa.



Conclusions

1. The catalytic polymerization process yields a liquid boiling within the gasoline range, with relatively few hydrocarbons present.

2. Due to the mild operating conditions employed, temperatures for polymerization of about 400° F. and pressures of 200 pounds per square inch, the process is economical to operate.

3. The high octane rating and blending value of polymerized gasoline gives it a high market and efficiency value in comparison with standard gasolines.

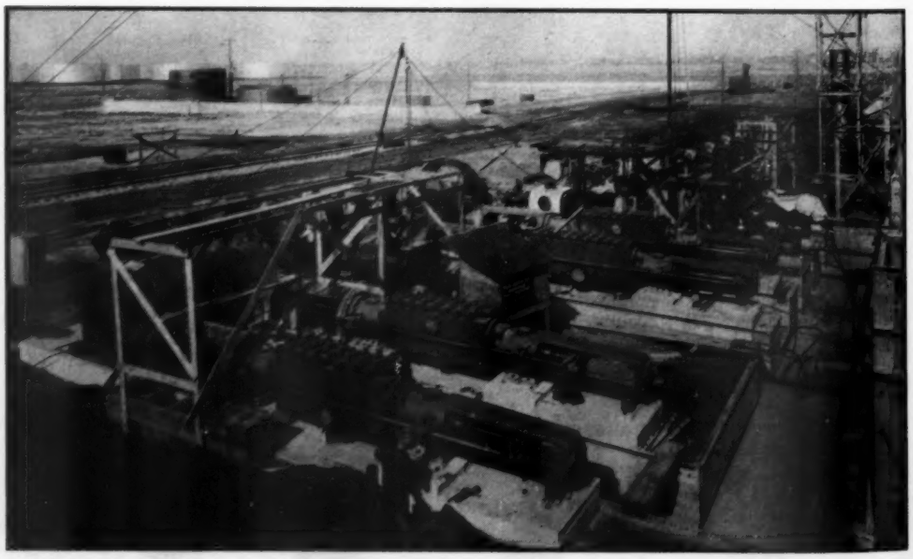
4. Polymer gasoline has a higher blending value than either benzol or iso-octane.

5. By polymerizing the isobutene present in the butanes and butenes fraction and mild hydrogenation of the di-isobutenes, 95 to 100 octane motor fuel is produced.

6. The catalytic dehydrogenation of propane-butanes followed by catalytic polymerization converts over 75 per cent by weight of the gas into gasoline.

7. The manufacture of gasoline by polymerization makes possible greater conservation of crude oil supply, due not alone to less crude oil required, but also to the higher efficiency obtainable from polymerized gasoline as such and from fuels with which it is blended.

8. Over 9,000,000,000 gallons of polymer gasoline are potentially available from the hydrocarbon gases in the United States, of which over 1,000,000,000 gallons can be converted into 95-100 octane gasoline.



Construction under way in the Wilshire refinery at Norwalk, California

Application of Unitary Thermal Polymerization Process

(Continued from Page 138)

lized to a Reid vapor pressure of 10.5 pounds. Its composition is predominantly paraffinic and a considerable portion of the paraffins are isoparaffins. It may be clay treated without appreciable loss of octane value to low copper dish gum and a stable 30 plus Saybolt color and it is also readily susceptible to acid treating.

In general, the product of this process is characterized by high volatility (although this is subject to some variation), high blending value, low copper dish gum, and a satisfactory induction period. The output from the Phillips Petroleum Co. unit at Borger has an induction period of over 240 minutes when treated with not over 1 pound of B.A.P. per 100 barrels.

It is obvious from Figures 3 and 4 that this polymerized distillate can be used directly for high volatility motor fuel, but in most cases it is probable that its greatest utility will lie in using it as blending stock, where it constitutes only a fraction of the total refinery output and its economic value is correspondingly enhanced by the high proportionate blending value when it is used in small percentages.

The economic analyses of the process which have been made in conjunction with many refinery engineers indicate clearly that the cost of conversion in the unitary thermal process lies well within the economic limit when based on the usual values of natural gas residues and refinery gases appraised on a fuel oil basis. One example, given in the article to which reference has been made (2), indicates in this instance a total manufacturing cost of 3.5 cents per gallon of product. Its flexibility as regards charging stock composition has been amply demonstrated and feed stocks varying from either propane or butane, or any mixtures of these, to complex mixtures of C_3, C_3 and C_4 compounds in which the unsaturates may amount to as high as 80 per cent, may be effectively handled without separation either in the plant indicated in diagrammatic form (Figure 1) or in known modifications.

While the process may be aptly described as controllable synthetic conversion of hydrocarbons to motor fuel, it is an extremely effective and normally economical means of conserving those fractions of natural and refinery gases which have been hitherto wasted or utilized simply as fuel.

Ethyl Gasoline Corporation's Scientific Demonstrations

More than 500 scientific demonstrations were conducted in the schools and colleges of the United States and Canada last year by representatives of the Ethyl Gasoline Corp. In California, 107 lectures were attended by 13,144 students. Seventy-five demonstrations were given in the Chicago area. Wisconsin reports a total of 61; southern Illinois, 39; and North Carolina, 30.

The emphasis of school authorities on industrial science is a new trend in education, it is pointed out. The student's interest in scientific studies is aroused by showing the application of theoretical knowledge to the familiar objects of every day life.

Graduate and undergraduate students in chemistry, physics, engineering, automotive and aviation engineering were initiated into the chemistry of petroleum and gasoline as well as the use of gasoline in the internal combustion engine during demonstrations at the following educational institutions:

Johns Hopkins University, Goucher College, William and Mary College, Georgetown University, Duke University, Loyola College, Maryland College for Women, Virginia Polytechnic Institute, North Carolina State College, South Carolina State Agricultural and Mechanical College, Mississippi State College, Ohio Northern University, Case School of Applied Science, Ohio State University, Lathrop Polytechnic Institute, Montana State College, North Dakota Agricultural College, Aeronautical University in Chicago, the Wilbur Wright Technical School, Detroit, and the universities of Illinois, Louisville, South Carolina, Kentucky, North Carolina, Virginia, Delaware, Maryland, Georgia, and Mississippi.

Student officers at the Tank School at Fort Benning, Ga., attended demonstrations, as did young men at the Citadel, military college of Charleston, S. C. Cadet pilots at Randolph Field, San Antonio, Tex., heard lectures by representatives of the Tulsa Division, and the motorized artillery unit at the barracks of the U. S. Army in Madison, N. Y., witnessed one of a number of demonstrations at army barracks.

Scores of high school, vocational and technical secondary schools asked for more than one demonstration during the year. An ambitious program of lectures has been arranged for this year by all divisions.

"The interest of the students in such demonstrations of applied science is extremely keen," it is reported. "Many of them expect to do research for corporations when they are graduated. They are eager to see how their classroom studies may be applied to the problems of earning a living in later life.

"The enthusiasm of teachers for such demonstrations represents a more modern trend in education. It is directly in line with the theory of teaching which several of the foundations are trying to foster. This theory suggests that the beginner's interest in science may be excited more quickly by dealing with familiar things at first than by assigning a series of fixed experiments which are entirely foreign to his experience.

"Most educators find that it is easier to interest a boy in what makes an automobile run than to fix his attention on an abstract subject like the oxidizing of petroleum. Once the first interest is aroused, the rest is easy. Advanced students show intense interest in the elaborate chemical reactions which take place inside an automobile during operation."

Announcing

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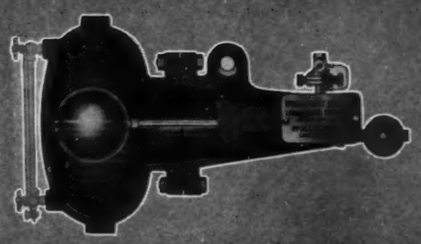

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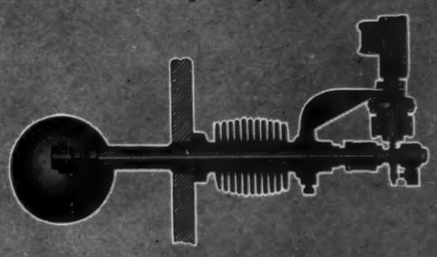

No. 852. Controller

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Designed particularly to throttle and average over the entire travel of the float, and *automatically reset* for any increase or decrease in thruput. It can easily be set to maintain a close level when required.

Pilot is entirely mechanical—so simple in design that anyone can adjust it on the job. It is flexible, accurate, dependable and economical.

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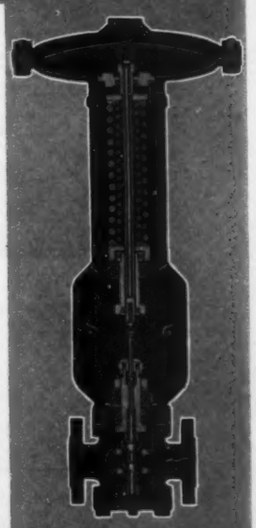
See cracking section for other McAlear equipment.



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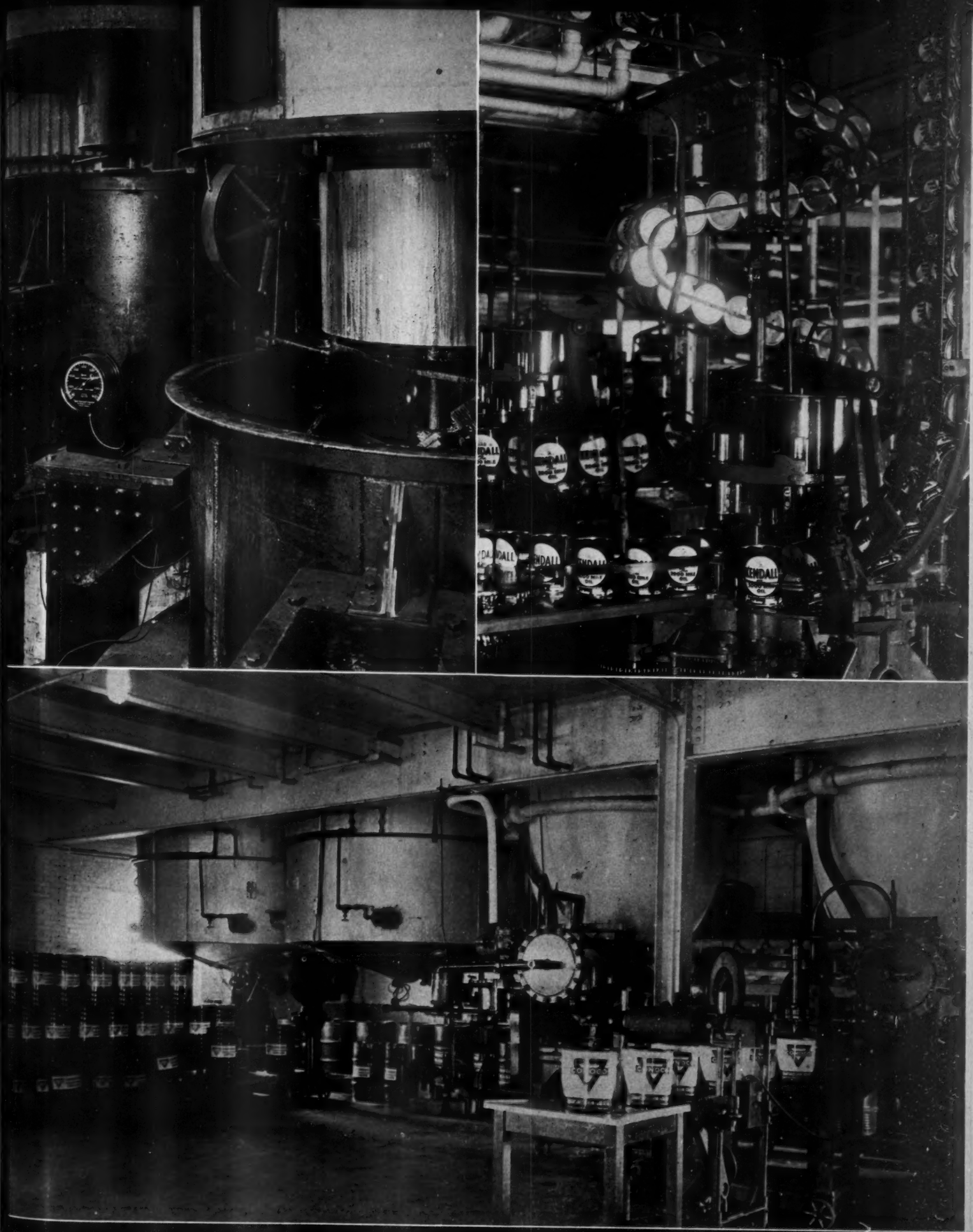


Grease Making - Compounding - Packaging

Most Lubricants Must Be Packaged TO SELL

Petroleum lubricants did not begin to make important inroads on the markets served by animal and vegetable fats until 10 years after the completion of the first well drilled for crude oil. That this delay is not attributable to lack of effort or confidence on the part of refiners is clearly seen in the early advertising of petroleum companies. Witness the announcement of "A Perfect Cylinder Oil" in 1868 by the Continuous Oil Refining Co., of Binghampton, N. Y.:

"All skilled mechanics have long known that no specific cylinder lubricator has yet made its appearance (with the exception perhaps of sperm oil) but contains serious defects. Tallow, tallow oil, and lard, most generally in use, work well for a period; but the stearic, margaric and oleic acids, which the above, and all other animal oils contain, in time corrode and destroy the metal. Every mixture in use is alike objectionable, as this destruction surely follows, although escaping notice for a time, ultimately is found to have damaged beyond the reach of repair. The chemist, years ago, found by careful analysis, that petroleum, from its entire freedom from acid and oxygen, possessed the necessary requisites to make a perfect cylinder oil—provided a process could be invented by which the undesirable qualities could be extracted without destroying the nature of the globules of oil which constitute its value.

"We have succeeded! This is proven by more than two years' experience in tests of the severest kind on stationary and locomotive cylinders, where exposure to the most extreme heat and pressure has been had to try its strength and durability. Its equal cannot be found, clinging with more tenacity to the metal, and resisting the great pressure of steam, it remains in the cylinder performing its work, while lard and tallow are blown away. In commencing its use, the first duty it performs is to thoroughly dissolve the accumulated gum of animal oils. During this period of cleansing, signs and seeming evidences of an indifferent oil will be indicated. A continuance of its use for a short time, however, will prove what we have claimed for it. An inspection of the piston rods, bolts, etc., will show that they have become apparently 'case hardened.' Wear and corrosion has entirely ceased. The surfaces are as true and the metal as sound as if unused."

Pioneer petroleum grease makers were filled with secret formulas and many years were to pass before there was more or less free interchange of ideas. The earliest grease plants were little more than old sheds housing direct fired open kettles. The principal product was a mixture of crude oil, resin oil and lime water. The writer is indebted to C. W. Georgi, of Enterprise Oil Co., Inc., of Buffalo, N. Y., for the following review:

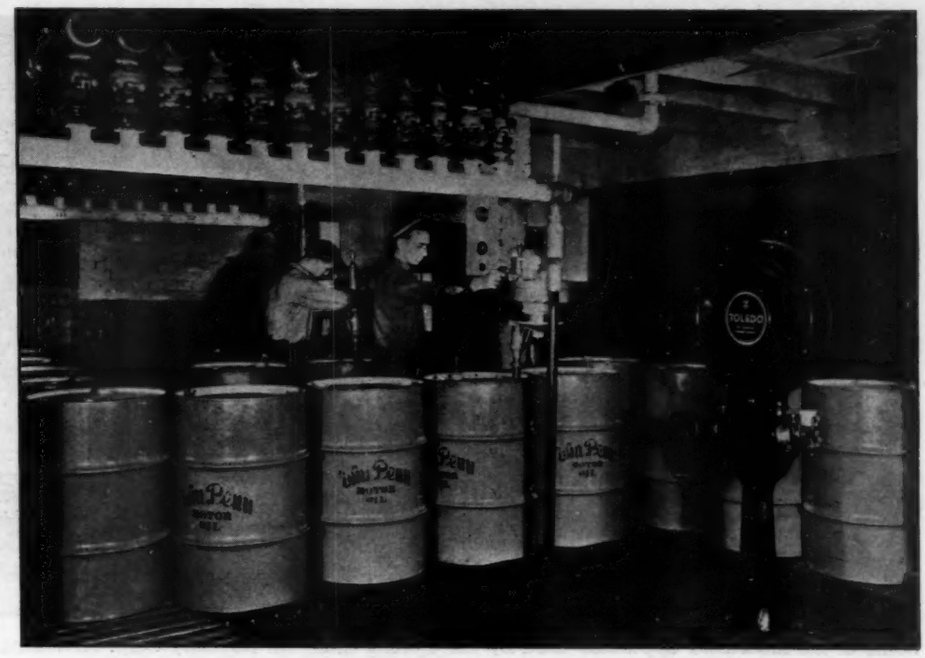
"Today it seems strange indeed that a cup grease composed of a light, nonviscous mineral oil thickened with a calcium soap base should have been used as a lubricant for gears. However, it will be remembered that heavy bodied or viscous mineral oils were scarce, if available at all. Refiners were just beginning to learn how to isolate the heavier lubricating fractions from the crude and were still concerned chiefly in the manufacture of kerosene. The conversion of such nonviscous neutrals to a nonfluid form was a matter of necessity because of the leakage problem. The housings on the early gear units were little better than loose fitting covers.

"However, as the automobile developed and adventurous motorists began to drive at speeds of 20 or even 30 miles per hour, the gear boxes developed heat sufficient to melt and break down the grease, causing foaming and drippage. It was at this point that automotive lubrication began to become a separate and special problem. A few of the developments occurring during the past three decades can be recalled as follows:

"Gear lubricants of sufficient fluidity to provide adequate lubrication at winter temperatures as well as of sufficient body and stability to lubricate at elevated temperatures were produced. Water resistant pump greases followed the adoption of circulating cooling systems. Elimination of chain drives in favor of the long propeller shafts with one or more universal joints, called for another special lubricant. Elimination of grease cups from

chassis fittings and substitution of special nipples permitting the use of pressure operated grease gun equipment required softer greases having drip resistance, greater lubricating value and freedom from particles which might cause gun stoppage. With the introduction of four-wheel brakes, small diameter wheels, low pressure tires and higher car speeds, the matter of wheel bearing lubrication became of major importance. Special wheel bearing greases having high melting point, great resistance to breakdown, and added ability to lubricate under the severe loads on the wheel bearings became necessary.

"One of the most recent developments has been that of extreme pressure lubricants. With the continual trend of more and more horsepower development by engines, coupled with the necessity of keeping weight and vehicle height at a minimum, the unit pressures on gear teeth in transmissions and differentials have increased tremendously. The point has been reached in many instances where the gear tooth pressures have become so great as to squeeze out ordinary mineral oil lubricants with resultant metal to metal contact and gear failure."



A close-up of a filling lane in the Canfield lubricating oil plant showing the Bowser filler, oil manifold and weighing equipment. By opening the valve controlling the flow of oil from the overhead lines it is possible to fill the drums with the required grade of oil, each gate being marked with the S.A.E. number of the oil

Grease Manufacture

Before discussing the manufacture of petroleum greases, it may be well to outline their application and the reasons for selection of widely differing types of greases. It is generally conceded that greases should not be used where oil will serve the purpose economically. John D. Gill summarizes the conditions which warrant uses of grease lubricants as follows:

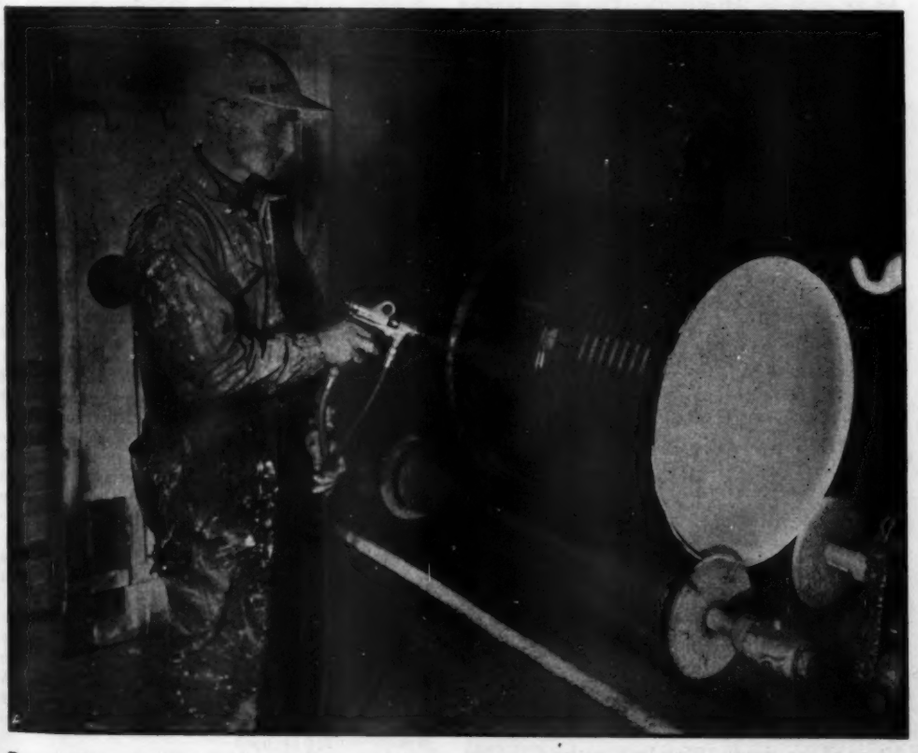
(1) In bearings where total frictional loss with grease is negligible. (2) Where operation is intermittent to an extent that would permit oil lubricants to flow from the bearing surfaces between applications at reasonable intervals. (3) When use of oil would cause damage by splashing or dripping. (4) Where bearings are difficult of access and lack of interest on the part of operators make intervals between applications extensive. (5) For bearings operated at very slow speeds or with wide clearances, wherein the frictional coefficients will be lowered with grease applications because the greater film thickness maintained by the grease more than counterbalances the greater resistance due to its high consistency. (6) Where bearings operate at high temperatures and are not equipped with suitable oil applying and recovering systems. (7) Where the grease serves more as a noise and shock absorber than as an actual lubricant.

Grease Application

Grease may be applied to bearings by means of three types of hand screw cups, or by the ratchet type cup wherein the rotation of the threaded piston is accomplished automatically by a moving machine part at an adjustable rate. The simplest cup is that in which the upper portion is threaded internally and is screwed over the bottom part of the cup. The screw piston cup eliminates the moving upper portion and substitutes a plunger which is screwed down. In the third type of hand cup a spring and plate exert a constant pressure on the grease. This is known as the automatic spring feed cup.

The hand grease gun has been spoken of as a portable screw cup. The cup on the bearing or surface to be lubricated has been replaced by a check valve fitting. The grease gun hose outlet is attached to this fitting and the turn of a piston forces the grease past the check valve into the parts to be lubricated. The motor driven grease gun is a mechanized edition of the hand unit.

The cup type feed is applicable where no reserve supply of grease is available between compressions and where the lack of uniform lubrication and the slow deterioration of the small grease supply are not important factors. Where positive feed and closely adjusted flow of grease to all points to be thus lubricated is essential, the force feed grease lubricator may be used. In this installation the grease in a cylindrical tank is pushed past a screen into a lower chamber by a rotating scoop and helical disk feeder. In the lower chamber the one or more pumping units may be set for any desired rate of feeding. In pneumatic and hydraulic grease lubricating systems the grease is fed from individual tanks at each lubricating point by automatic application of compressed air or hydraulic pressure.



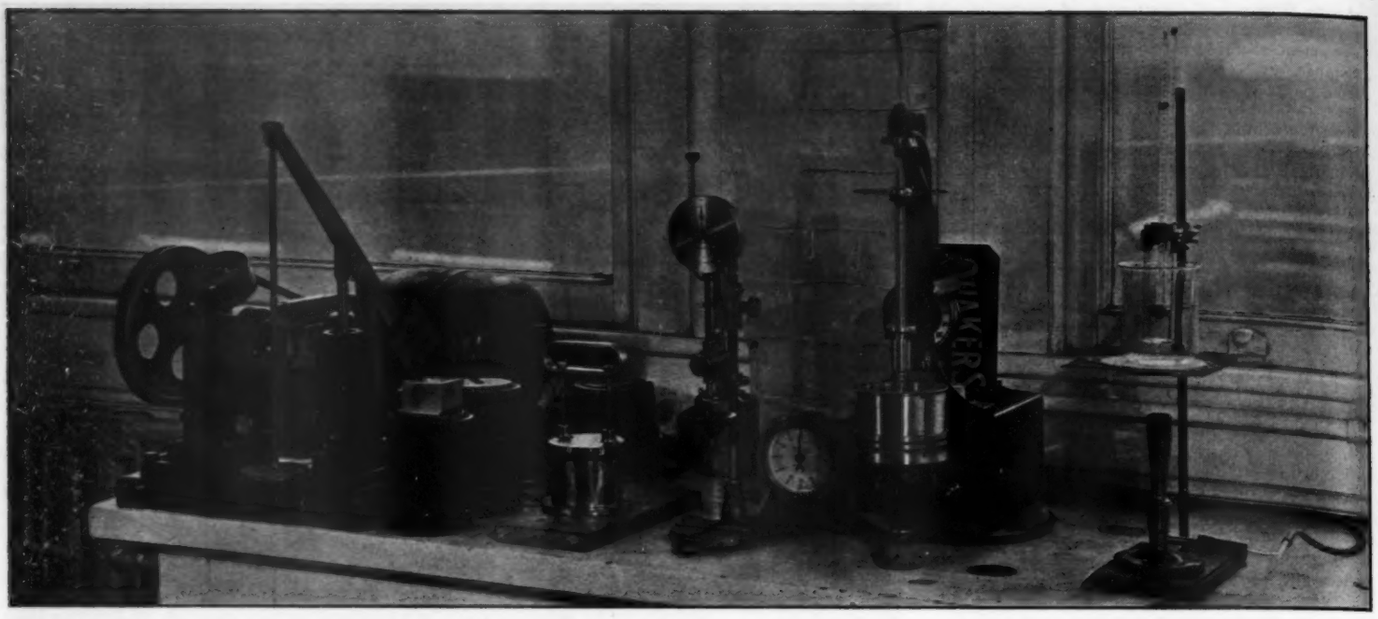
Repainting oil drum with spraying machine in the new Coraopolis, Pa., lubricant plant of the Canfield Oil Co. The drum is slowly revolved by a mechanical drive at the rate necessary to allow the workman to administer an even coat of paint. After the paint job is complete the drum is transferred to a conveyor taking it to the drying oven

Grease Classifications

Probably one of the clearest discussions of the art of grease making was that of F. M. Simpson and C. C. Wilch, "Factors in the Manufacture of Grease," which appeared in the March 12, 1931, issue of The Oil and Gas Journal. The authors classify greases roughly into three major groups: (1) Admixtures of mineral oil and solid lubricants; (2) blends of residuum, waxes, uncombined fats, resin oils and tars; (3) soap thickened mineral oils. Interest here is principally in the mineral oils thickened with soaps in varying percentages and of widely differing compositions.

Filled Greases

The first group, mineral oils combined with graphite, mica, and for special uses, the nonlubricant, asbestos fibers, are used where uneven surfaces are to be conditioned for lubrication, in loosely fitting gearing where tenacity and shock absorption are considerations, and, in general, where heavy moving parts operate intermittently and at slow speeds. Greases in the second group are valuable for their ability to adhere to metallic



Some of the laboratory apparatus used by the Quaker State Oil Refining Corp. for testing and controlling the manufacture of greases. From left to right: (1) Almen E. P. testing machine for determining the load carrying properties of greases and gear lubricants. (2) A.S.T.M. grease worker used for testing the differences between "worked" and "unworked" greases; the breakdown of greases, etc. (3) A.S.T.M. grease penetrometer, used as a control test for maintaining the consistency or "body" of greases within uniform limits. (4) MacMichael viscosimeter used for studying the viscosity properties of non-fluid or extremely viscous lubricants. (5) Melting point apparatus used for determining the flow or drip point of greases. These represent the majority of instruments used by companies in testing greases

surfaces and their heavy body, assuring protection as steel cable lubricants, as lubricants for dredges, cranes and other equipment operating in water or exposed to extreme weather conditions.

In the third group, the authors mention among the thickeners employed sodium, calcium, aluminum, lead, potassium and zinc soaps. These soaps being prepared by the saponification of a fatter glyceride of either animal or vegetable origin. The saponifiable oil, usually, is heated with the metallic salt until saponification is completed. The mineral oil is then worked into the soap. The more involved substitution method will be discussed later

Control of Properties

Property of the grease is largely dependent upon the metallic salt used in saponification. Sodium and potassium greases are highly soluble in water and have high liquefaction temperatures; lime base greases are insoluble in water and are unstable at temperatures above the boiling point of water as the calcium soap is not a true solution and separation of the water takes place readily; lead and zinc soaps are heavy and have comparatively low melting points; the aluminum base soaps may be considered in a class of their own as all the ingredients in an aluminum base grease share importantly in the properties of the finished product, and the rate of cooling strongly affects the texture and consistency.

The lubricating value of the grease is largely controlled by the mineral oil used, the heavier oils giving greater film strength. The type of saponifiable oil controls to some extent the degree of metallic adhesion, cohesive character and texture. It is highly important to check closely the color, odor, melting point, acidity and per cent of unsaponifiable material in the animal or vegetable oils and fats used. Animal and vegetable oils commonly used in compounding greases are:

Whale oil, a brownish yellow oil of disagreeable odor rendered from whale blubber; lard oil, made from fresh lard, obtained from the fat of hogs; neat's-foot oil, obtained by boiling cattle feet; tallow oil, made from beef tallow by pressure; sperm oil, taken from the head of the sperm whale; cotton seed oil, expressed from cotton seed and ranging from deep yellow to dark reddish yellow; rapeseed oil, which is partly oxidized by blowing; castor oil, which has an unpleasant odor; resin oil, produced by destructive distillation of pine resin. The saponification value of these oils is expressed in the number of milligrams of potassium hydroxide required to saponify one gram of the oil.

There are three types of kettles used in the manufacture of greases. Where high temperatures are not required the open type steam jacketed kettle is generally used. The advantages listed for this kettle are: Ease with which it may be charged and cleaned, even distribution of heat, close temperature control and economical operation. Saponification takes place slowly and is not always complete. The comparatively low temperature limit prevents complete dehydration of certain soaps. The closed pressure type steam jacketed kettle reduces the time required to saponify oils and fats by as much as three-fourths. The usual practice is to make the soap in the pressure kettle and then complete the compounding in the open type kettle. While the oil is being worked into the soap the pressure kettle is again charged so that manufacture is practically continuous. The directly fired type of kettle is used in making special greases which require high temperatures.

Lime soap base greases are most widely used

View of the drum filling line in the Oil City, Pa., refinery of the Pennzoil Co. The oil is pumped to the loading line under pressure where it is placed in drums which move down the conveyor to the filling point

in cups, ball and roller bearings, axles and water pumps. Soap percentages range from 4 to 25. The cold set lime soap base greases are made by mixing resin oil, lime and petroleum oil, saponification taking place without the application of heat and is rapid. These are the cheapest greases and because of the excess of lime, which abrades highly machined parts, they are not used where higher priced greases can be used. The hot mixed lime soap base greases are made by saponifying the animal or vegetable oil with an exactly measured quantity of lime in the open or pressure steam jacketed kettle, and then working in the petroleum oil.

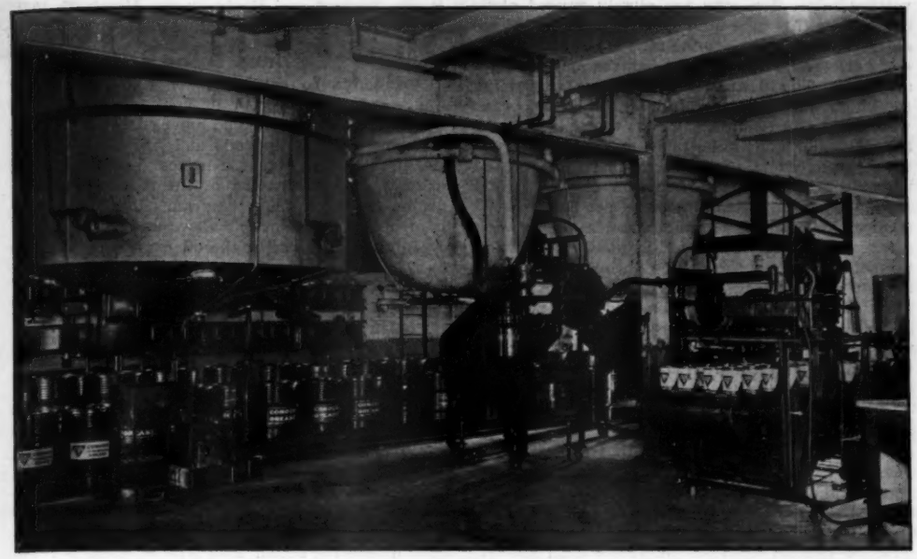
There are two methods of making the lime soap grease, the dry and the wet. In the dry method the saponifiable oil and lime, with an excess of water, are cooked with vigorous agitation until all of the excess water is evaporated. Agitation continues after the heat is turned off until the soap is slightly cooled. The petroleum oil and water are then worked in. In the wet method, which gives less consistent results, less water is added and the soap is cooked down to the desired water content after which the petroleum oil is mixed in.

Pressure Kettle

If the soap is made in the pressure kettle saponification is much more rapid and complete. The kettle is charged with the accurately measured ingredients and after closing the pressure builds up to as much as 85 pounds because of the heat. After 25 to 45 minutes saponification is complete and the soap is transferred to an open kettle under its own pressure. The water in the kettle is flashed off and additional moisture must be added to the soap in the open kettle. The best lime soap base greases are made with slightly less than the required quantity of lime, the reaction being completed with another agent. In addition these greases are carefully filtered and are free from abrasive material.

Lime soap greases are marked by their insolubility in water, buttery texture in instability at temperatures above 212° F. The low degree of cohesion in these greases makes them suitable for high speed bearings. Where longer shear or stringiness is required in a grease to follow gears, lime soap greases cannot be used.

Gear and high temperature bearing lubrication find the soda soap greases highly suitable. These greases are soluble in water. In making soda soap greases accurately measured quantities of saponifiable oil and caustic soda are charged into the



View of the filling floor of a Continental Oil Co. grease plant showing the filling equipment for small cans and a portion of the conveyor for filled barrels. The filling machine is equipped with rollers so that it might be moved to the kettle to be used in filling the cans.

kettle. As in the case of lime soap greases, a small amount of petroleum oil is added to soften the soap and facilitate the further addition of petroleum oil. After complete saponification the soap is cooked to the desired texture and the remainder of the petroleum oil is added. The texture of soda soap greases, unlike that of the lime soap greases, is largely controlled by manufacturing method and less by the saponifiable oil selected. These are known as fiber greases and liquify at temperatures from 350° F. to 450° F. They show less change in consistency with rising temperatures than other soap-oil greases.

Dehydrated soda soap greases are made by heating the finished fiber grease to above the liquefaction point. These greases are cooled in block molds and are much harder than fiber greases. The direct fired kettle must be used. The dehydrated soda soap greases contain from 15 to 50 per cent of soap and will stand up under temperatures up to the point where distillation of the petroleum oil takes place.

The fiber or gear greases require a low viscosity petroleum oil and contain from half of 1 per cent to 10 per cent of soap. Consistency ranges from fluid to semisolid. The spongy texture of the soda soap greases is controlled by the amount of water and glycerin left in the soap.

Aluminum Base Greases

The manufacture of aluminum soap greases is filled with difficulties. These greases, similar to the lime soap greases in application, are characterized by a brilliant transparency and stability at high temperatures. The oleic acid aluminum soap is highly cohesive, rubbery in appearance, while the stearic acid aluminum soap is marked by low cohesion and buttery texture, when these soaps are mixed with a low viscosity petroleum oil. With a very light petroleum oil the aluminum soap yields a grease of softer consistency than with a heavy petroleum oil. The rate of cooling strongly affects the consistency.

Simpson and Wilch describes the manufacture of aluminum soap greases as follows: "The manufacturing procedure for aluminum soap is different from that of other soaps in that it is a product of a substitution reaction. The fat is first saponified with caustic soda. By addition of an aqueous solution of an aluminum salt the sodium radical of the soap is replaced by aluminum. The water insoluble aluminum soap separates permitting the solution containing the sodium salts to be drawn off. By repeated washing the soap is freed of all excess of saponifying agents. Aluminum soap greases, when properly made, possess all the favorable characteristics of calcium soap greases and are without the unfavorable characteristics, including the possible presence of abrasive substances." Because of the inconsistent results obtained with aluminum soaps when cooling is uncontrolled, the finished greases are drawn from the kettle into shallow pans. These pans are placed on racks in a room in which the temperatures are not permitted to vary widely.

Extreme Pressure Greases

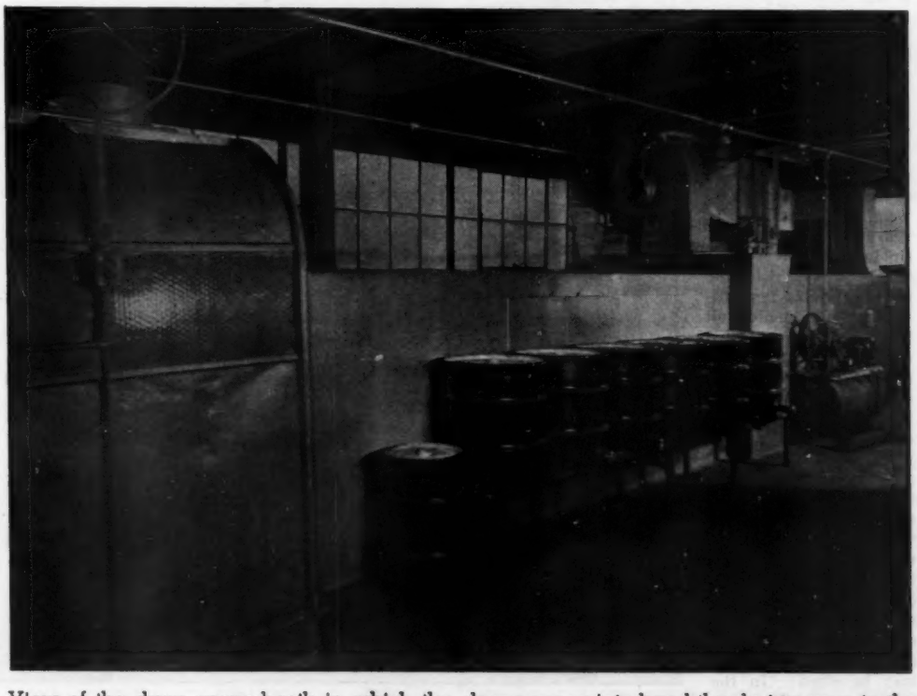
Use of materials which impart extreme pressure lubrication characteristics is urged by O. L. Maag in the October 18, 1934, issue of The Oil and Gas Journal. "Many greases," he says, "used for roll neck plain bearings are compounded from heavy black oils, soaps, and various percentages of fillers such as lime, talc, mica, zinc oxide, etc. The fillers serve to polish the bearings, giving in a short time well run-in bearing surfaces, However, the disadvantage of these products is that they continue to wear away the bearings, with the result that replacements are usually quite high. This company (Timken Roller Bearing Co.) has specified that steel mill greases for use with their bearings should carry a minimum load of 33 pounds on the Timken lubricant tester, and be of proper consistency for local operating conditions. The types of extreme pressure lubricants with which the company has had success are those having a lead soap sulfur base, a chlorinated sulfur base, and the straight chlorinated base products. More attention should be directed toward the use of definite chemical compounds, such as hexachlorethane, chlorinated retene, etc., instead of trying to sulfurize and chlorinate complex fats whose resultant product is variable and unknown."

Lead base greases, used in gear lubrication, are characterized by great adhesiveness to metal surfaces. These greases give good performance at high speeds and under heavy loads. The lead soaps are made by direct fusion of lead oxide and heated saponifiable oil. By using the substitution method, however, the disadvantage of uncombined lead oxide which remains in the soap is eliminated. Lead soaps which are but slightly soluble in petroleum oils are made when fatty acids of the acetic series are used, while fatty acids of the oleic series produce soaps which are highly soluble in petroleum oils.

Greases may be tested for acidity or alkalinity by melting and testing with litmus paper. Volatility may be determined by heating a measured quantity of grease to 200° F. for two hours and then weighing to determine loss. Lubricating value may be determined by such frictional machines as the Almen, Cornell, Underwood, etc. Greases are graded in accordance with their consistency. The consistency of a grease is determined by means of a cone type penetrometer. The penetration is the rate at which the plunger sinks into the grease in five seconds. The following table shows the A.S.T.M. gradings:

Grade	Penetration m.m.
0	350
1	300
2	250
3	200
4	175
5	125
6	100

C. L. Knopf, speaking before the American Chemical Society in Chicago in 1933, discussed methods for controlling greases, concluded as follows: More use should be made of the Saybolt Furol instrument, and larger orifices, for determination of heavy lubricants. The pressure viscosimeter is convenient and quite accurate for the determination of the apparent viscosity of fluid, semifluid and soft plastic lubricants. It is even fairly accurate testing universal joint greases, though consistency for such products seems to be more important. The higher the viscosity of the mineral oil and the greater the soap content



View of the drum spray booth in which the drums are painted and the drying oven in the Canfield Oil Co. lubricant plant. A mechanical conveyor moves the drums slowly through the oven which is provided with an exhausting system to remove the paint fumes from the oven. The exhausting system prevents the oven from becoming saturated with paint fumes

the greater will be the pressure viscosity. More pressure is required for higher soap contents. Insufficient pressure gives a value too high, whereas too great a pressure also gives too high a value because of the kinetic energy involved. In classifying greases, the consistency is usually more important than the viscosity of the mineral oil put in the grease. As consistency is the internal resistance of a grease to deformation, methods should be used which measure this property only. The following items should be observed: (a) Deformation should be at a constant rate. (b) The resistive force offered by the grease to its displacement should be a measure of the consistency. (c) The cross sectional area of the deforming tool or plunger should be uniform, not conical or spherical. (d) The adhesive property of the lubricant should be eliminated by avoiding contact of the shank with the lubricant at the time the resisting force is measured. (e) Very careful attention should be given to close temperature control. Control of 0.2° F. to 0.5° F. is possible.

Packaging

The earliest packaging problem of the oil business may be traced back to the heavy breakage losses among the ancients who transported petroleum in stone jars. Today the refiner's and the compounder's troubles are spread over hundreds of containers ranging from large steel barrels to tiny drop feed cans. The old barrel house has become one of the most complex units in the business of manufacturing and distributing petroleum products, and, one of the most efficient.

Before the advent of the service station in 1908, the consumer purchased gasoline and kerosene, as well as lubricating oils, in 5-gallon cans and even in barrels. This practice has by no means been discontinued entirely, particularly in the rural districts. The bulk of packaged sales, however, is in motor oils, greases, and specialties. The manufacture of the packages by refiners themselves was an economical practice, records show, before 1880 when the oil companies made 23,496,916 tin cans and purchased 344,173; made 3,292,608 bbls. and purchased 6,424,608; made 1,607,297 packing cases and purchased 4,845,504. Today, certain refiners sell their surplus container production to food and other canners.

The most recent important development in packaging was the advent of the 1 and 5-quart size cylindrical "tamper-proof" cans for motor oils. Ostensibly produced to eliminate contamination and substitution of branded products, the small cans greatly simplified the distributor's inventory problem, promoted the sale of premium oils, and increased the refiner's unit costs by several cents. The advantages and disadvantages of these small containers had been weighed for at least 12 years before a comparatively small refiner "broke the ice," with the introduction of Pennsylvania Grade motor oil in "refinery sealed cans." In 1929 another marketer of Pennsylvania Grade motor oil initiated the sale of lubricants in 2-gallon cans when the lease and agency contract closed thousands of outlets to the small sellers.

As an interesting contrast to the modern motor oil canning plant in which each machine fills and seals two cans per second, the operation of a similar plant in 1880 may be cited: "In the larger establishments the packages (5-gallon tin cans) are filled by weight on a square revolving table. Ten cans are closely ranged along one side of this table and brought beneath 10 funnels, which deliver oil to the cans until their weight stops off the oil by tipping a balance and closing a stop-cock. The 10 cans are then swung out by giving the table a quarter revolution while these cans were being filled another 10 cans were placed upon the adjoining side of the table, and when the first were swung from under the funnels the second were brought into their places. While the second 10 cans are being filled a third set are being placed upon a third side of the table, and a nozzle, with a cap that screws on and off, is placed in position for soldering over the orifice through which the first 10 cans were filled. The table is again swung, the third set of cans are brought into position, and are then filled; the second set are supplied with nozzles, while the nozzles of the first set are soldered on and the fourth side of the table is supplied with 10 cans. Several thousand cans can be filled in this manner at one of these tables in a single day.

In the modern plant the filling machine will turn out 7,200 sealed 1-quart cans of motor oil, or 2,400 of the 5-quart size, in one hour, delivering them to a unit which packs them in cartons which are automatically closed and sealed. The empty cans are kept in air-tight containers until shortly before use. When the can filler is to be started up the "empties" are loaded horizontally on chutes which may extend from the floor above to the filling machine. The cans are up-ended automatically before entering the filler and after being supplied with an accurately measured quantity of oil the cans move on to the sealer at a rate as high as 130 cans per minute. In the sealer the cans are supplied with covers from a magazine. These covers are fed out as each can trips a lever and take a position over the can top at a point where the machine rolls the cover and can securely together.

After the cans are sealed they are automatically turned on their sides and rolled to an automatic packing machine. Here the cans are placed in cartons, 24 to each carton, and move on to the carton sealer. This unit spreads glue under the flaps, presses them down, and then passes the closed cartons to a compression unit where the boxes rest for one minute to permit the glue to dry. An automatic conveyor system takes the sealed cartons to awaiting trucks, railroad cars, or to the warehouse. A highly efficient conveyor system is described by Bown, Wolbert and Healy, in the March 29, 1934, issue of The Oil and Gas Journal.

Drum Filling

Drums to be filled may be rolled into place under the filling line or brought into position on roller conveyors. The trend among smaller refiners who make lubricating oils and greases is toward the practically automatic system extending from drum storage to loading of the filled and sealed drums for shipment. A diagram of such a system is presented in the article above mentioned.

Rotary pumps bring the oil from storage tanks to the drum fillers. The oil lines, usually 2-inch, are all equipped with piston meters for accurate measurement of the oil delivered to each drum. If, for example, a 55-gallon steel drum is to be filled, 52 gallons are metered into the drum in a period of about two minutes, the bung and air vent openings are screwed in and a tin seal is clamped over the bung. This seal cannot be removed without its destruction.

Tamper Proof

There are a number of refiners who do not reuse old drums. One refiner uses a "nonrefillable" drum which is equipped with a suction assembly built within the drum. This type of drum is filled in the same manner that the ordinary drum is. However, when the oil is to be removed the sealed bung near the edge of the cover is left undisturbed, and an external pump section is screwed into the three-quarters inch vent and slot connection in the center of the cover. The two pump sections, internal and external, operate as a unit.

Packaging Greases

Greases, ranging from heavy fluids to brittle blocks, require a wide variety of filling methods and packages. Greases may be packed in cans, cartons, wooden boxes, leak-proof cloth bags, collapsible metal tubes, and in containers which include built-in sections of a dispensing system. The grease may be molded into blocks or forced through perforated plate to form long cylinders. The lighter greases will flow by gravity through large diameter pipe to the filling table. Heavier greases may require pneumatic or hydraulic pressure to force them into the containers. It has become quite general practice to pump certain types of greases through banks of filters before packaging. Each tank of finished grease may be equipped with a pump, but it is usual practice in small plants to use one pump for two or more tanks, and one metering filler is made to suffice. A portable pump and filter assembly may be wheeled over to any tank.

The use for which the grease is intended often controls its form and packaging. Brick greases may be sent in cartons or wooden boxes as single slabs to be cut into the desired sizes to fit properly in the bearing grease containers. Pinion and similar type greases may be prepared in sticks for convenience. Gear and lighter greases are packaged in collapsible tubes of metal or specially prepared cloth bags fitted with appropriate nozzles. One refiner has developed a special metal can and dispensing tool which operates with all the efficiency of a well built grease gun and eliminates the usual bother of filling the grease gun from another container. The can is fitted into the compact unit and takes the place of the regular barrel, usually a part of the gun.

Units for filling small grease containers in the Quaker State grease plant. The grease is pumped under pressure to the filling tables. By means of scales attached to the filling arm the correct weight of grease is placed in each container at the time of filling

Personnel of Refineries in United States

Abbreviations Used:

Chm. Bd.—Chairman of Board
Pres.—President
V. P.—Vice President
Sec.—Secretary
Treas.—Treasurer
Gen. Mgr.—General Manager
Gen. Supt.—General Superintendent
Sales Mgr.—Sales Manager
Tank Car S. M.—Tank Car Sales Manager
Station S. M.—Station Sales Manager
Pur. Agt.—Purchasing Agent
Traf. Mgr.—Traffic Manager
Ch. Egr.—Chief Engineer
Supt.—Superintendent
Asst. Supt.—Assistant Superintendent
Ch. Chem.—Chief Chemist

A

Acme Refining Co., Gladewater, Tex.
Owners, J. N. Whitlock, Elbert Holmes and J. H. Talley
Refinery located at Gladewater, Tex.

Adams Refining Co., Big Spring, Tex.
Owner, A. J. Adams
Refinery located at Big Spring, Tex.

Aerex Co., Farmington, N. Mex.
Pres. and Gen. Mgr., A. C. Kittell
V. P., V. A. Kittell
Sec. and Treas., E. H. Kittell
Supt., E. H. Kittell
Asst. Supt., Gilbert Noland
Sales Mgr. and Pur. Agt., A. C. Kittell
Refinery located at Bloomfield, N. Mex.

Aetna Oil Service, Inc., 1202 South Third St., Louisville, Ky.
Pres. and Treas., W. R. Abbott
V. P. and Sec., W. T. Davis
Gen. Supt., E. E. Van Buren
Tank Car S. M., H. J. Flanders
Station S. M., Julius Malkemus
Pur. Agt., E. C. Wolff
Traf. Mgr., Charles Price
Refinery located at Louisville, Ky.

Ajax Oil & Refining Co., 811 West Seventh St., Los Angeles, Calif.
Pres. and Gen. Mgr., E. L. Cragen
Sec., W. G. Krieger
Treas., I. G. Krieger
Supt., P. A. Lawler
Sales Mgr., W. E. Williams
Refinery located at Clearwater, Calif.

Alamo Refining Co., Taylor, Tex.
Pres., G. L. Rowsey
Treas., Ben H. Harrison
Refinery located at Greggtown, Tex.

Allegheny Arrow Oil Co., Gambrinus Road, S.W., Canton, Ohio
Pres., Charles W. Wild.
V. P., R. V. Mitchell
Sec., Daniel C. Funk
Treas., Reid Brazell
Gen Mgr., Reid Brazell
Gen. Supt., Reid Brazell
Pur. Agt., Reid Brazell
Station S. M., J. F. Kennedy
Traf. Mgr., Paul T. Foust
Refinery located at Canton, Ohio.

Allegany Refiners, Inc., Bolivar, N. Y.
Pres., A. L. Shaner
V. P.s, C. A. Chipman and D. V. McCarthy
Sec. and Treas., Neil S. Sullivan
Ch. Chem., A. W. Wickham
Supt., W. V. Paris
Sales Mgr., Harvey L. Chambers
Traf. Mgr. and Pur. Agt., Hugh J. Arnold
Refinery located at Bolivar, N. Y.

Allstate Refining Co., Box 270, Tyler, Tex.
Pres., H. H. Coffield.
V. P., Geo. P. Mann
Sec. and Treas., J. H. Edwards
Gen. Mgr., J. H .Edwards
Gen. Supt., Geo. P. Mann
Sales Mgr., J. H. Edwards
Pur. Agt., C. A. Prater
Traf. Mgr., C. J. Demmer
Refinery located at Thrall, Tex.

Alton Refining Co., Gladewater, Tex.
Owner, T. E. Patten
Refinery located at Gladewater, Tex.

American Oil & Refining Co., 5776 Cherry Ave., North Long Beach, Calif.
Gen. Mgr., A. C. Mayrowitz
Refinery located at Hynes, Calif.

American Petro-Chemical Co., 309 Basso Bldg., Detroit, Mich.
Pres., Leo E. Jajoie
V. P., Arthur S. Hinsch
Sec. and Treas., Jack Mann
Asst. Sec. and Treas., Arthur S. Hinsch
Gen. Mgr., Arthur S. Hinsch
Gen. Auditor, Erwin C. Abitz
Refinery located at Wayne, Mich.

American Petroleum Co., Petroleum Bldg., Houston, Tex.
Pres., Craig F. Cullinan
V. P., G. O. Irvine
Sec., G. L. Townsan
Treas., C. T. Carnes
Supt., G. L. Hovey, Norsworthy, Tex.
Tank Car S. M., James P. Lavery
Ch. Egr., John H. Bringhurst
Ch. Chem., H. P. Sellers
Pur. Agt., W. G. Freitag
Traf. Mgr., J. E. Considine
Refinery located at Norsworthy, Tex.

Amsco Refining Co., Sames-Moore Bldg., Laredo, Tex.
Pres., Kent W. Bartlett
V. P., John D. Manley
Sec., R. J. Scatena
Treas., Forest D. Lowrey
Gen. Mgr., Kent W. Bartlett
Gen. Supt., Fred Geiger
Refinery located at Mirando City, Tex.

Anderson-Prichard Oil Co., Colcord Bldg., Oklahoma City, Okla.
Pres., L. H. Prichard
V. P., J. Steve Anderson
Sec. and Treas., Paul H. Anderson
Gen. Supt., Geo. H. Burruss
Supt., M. B. Burruss, Cyril, Okla.
Mgr. Ref. Oil Sales, C. L. Mayhall
Mgr. Tech. Naphtha Sales, C. H. Dresser
Ch. Egr., Geo. H. Burruss
Pur. Agt., W. M. Stirges
Traf. Mgr., M. H. Champion
Refinery located at Cyril, Okla.

Archer Refining Corp., 801 City National Bldg., Wichita Falls, Tex.
Pres., Geo. G. Golden
Sec., J. R. Small
Supt., W. E. Hames
Gen. Mgr., Geo. G. Golden
Tank Car S. M., Geo. G. Golden
Refinery located at Megargel, Tex.

Arktex Refining Co., Kilgore, Tex.
Owner, A. B. Riley
Refinery located at Kilgore, Tex.

Arro Oil & Refining Co., 603 Montana Bldg., Lewistown, Mont.
Pres., H. H. Schwartz
V. P., E. L. Allen
Sec., Guy R. Enlow
Treas. and Gen. Mgr., E. L. Allen
Gen Supt., Paul Jones
Tank Car S. M., T. R. Gilmour
Ch. Chem., Paul Cooper
Pur. Agts., E. L. Allen and Paul Jones
Traf. Mgr., T. R. Gilmour
Refinery located at Lewistown, Mont.

Arrow Refining & Producing Co., Fort Worth National Bank Bldg., Fort Worth, Tex.
Pres., H. B. May
V. P., O. B. Stephens
Sec. and Treas., F. H. Murphy
Gen. Mgr., O. B. Stephens
Gen. Supt., O. B. Stephens
Supt., H. L. Toups
Tank Car S. M., Henry B. May
Pur. Agt., O. B. Stephens
Refinery located at Overton, Tex.

Artex Refining Co.
Owners, Dick Duncan and Errol C. Holt
Refineries located at Arp and Longview, Tex.

Ashland Refining Co., Second National Bank Bldg., Ashland, Ky.
Pres. and Gen. Mgr., Paul G. Blazer
V. P., W. H. Keffer
Sec., E. L. McDonald
Treas., E. W. Seaton
Gen. Supt., F. W. Irwin
Tank Car S. M., E. F. Wells
Station S. M., A. A. Hines
Ch. Egr., C. C. Compton
Ch. Chem., C. O. Garbrecht
Pur., Agt., M. K. Lovell
Traf. Mgr., P. H. Banks
Refinery located at Catlettsburg, Ky.

Associated Oil Co., 79 New Montgomery St., San Francisco, Calif. (Subsidiary of Tide Water Associated Oil Co.)
Pres., Wm. F. Humphrey
V. P.s, L. F. Bayer, L. D. Jurs, B. I. Graves, J. H. Jenkins, E. L. Shea, W. A. Sloan
Sec., J. P. Edwards
Treas., W. A. Sloan
Gen. Supts., Wm. P. Hugo, Associated, Calif.; F. E. Coyle, Wilmington, Calif.
Asst. Gen. Supt., T. O. Edwards, Jr., Associated, Calif.
Supt., Frank Harris, Wilmington, Calif.
Domestic S. M., P. E. Allan
Fuel Oil S. M., E. Whitehead
Ch. Egr., H. B. Haney
Ch. Chem., L. Mittelman, Associated, Calif.; E. J. Lange, Wilmington, Calif.
Pur. Agt., A. P. MacKillop
Mgr. of Transport, H. T. Earl
Refineries—Avon Refinery, Associated, Calif.; Watson Refinery, Wilmington, Calif.

Atlantic Refining Co., 260 S. Broad St., Philadelphia, Pa.
Chm. Bd., J. W. Van Dyke
Pres., W. M. Irish
V. P.s, W. D. Anderson, R. D. Leonard, E. J. Henry, E. R. Cox, W. C. Yeager
V. P. and Sec., W. M. O'Connor
Treas., R. H. Colley
Mgrs. Ref., H. M. Nichols, Philadelphia, Pa.; G. E. Glines, Franklin, Pa.; M. J. Welsh, Brunswick, Ga.
Asst. Mgrs. Ref., W. F. Stroud, Jr., Philadelphia, Pa.; B. H. Waterbury, Franklin, Pa.; R. Stewart, Brunswick, Ga.
Domestic S. M., W. C. Yeager
Export S. M., W. D. Anderson
Ch. Egr., W. Samans
Ch. Chem., Dr. J. H. Boyd, Jr.
Pur. Agt., J. S. Parks
Mgr. Trans., W. C. Tuttle
Refineries located at Philadelphia, Pa.; Franklin, Pa.; Pittsburgh, Pa., and Brunswick, Ga.

B

B. & M. Refining Co., P. O. Box 127, Roundup, Mont.
Pres., Don J. Baize
V. P., Walter W. Baize
Sec. and Treas, Lee R. Milan
Gen. Mgr., Don J. Baize
Supt., M. H. Lewis
Ch. Chem., Wm. M. Jones
Refinery located at Roundup, Mont.

Bachmann Petroleum Corp., 1841 East Twenty-ninth St., Long Beach, Calif.
Refinery located at Long Beach, Calif.

Barber Asphalt Co., 1600 Arch St., Philadelphia, Pa.
Pres., Arthur W. Sewall
V. P.s, C. W. Bayliss, Frank Seamans
Sec., E. R. Riter
Treas., F. J. Robertson
Prod. Mgr., John H. Weller
Supt., Joseph Slutzker
Asst. Supt., H. J. Fleischer
Tank Car S. M., H. C. Hottel (Gen. Office)
Ch. Egr., Chas. T. McGrady, Maurer, N. J.
Director Techn. Bureau, J. S. Miller, Jr., Maurer, N. J.
Pur. Agts., John H. Weller, General Office; A. J. Hollenbach, Maurer, N. J., Local Purchases
Traf. Mgr., Joseph P. Brown (General Office)
Refinery located at Maurer, N. J.

Barnsdall Refining Co., Petroleum Bldg., Tulsa, Okla.
Pres., E. B. Reeser
V. P.s, F. E. Holsten, Geo. D. Locke,

Growth of Refinery Capacity in United States

Year—	Number of refineries	Total crude capacity (bbls. daily)	Number of operating refineries	Capacity of operating refineries (bbls. daily)
1914	176	.....	...	.....
1918	267	1,186,155	...	.....
1919	289	1,295,115	...	.....
1920	373	1,530,565	...	.....
1921	415	1,888,800	...	.....
1922	479	2,164,050	325	1,854,590
1924	574	3,046,790	362	2,549,490
1925	584	3,033,682	385	2,680,052
1926	515	3,068,340	356	2,770,340
1927	462	3,224,307	328	2,964,427
1928	456	3,426,330	315	3,116,930
1929	463	3,719,550	341	3,454,250
1930	479	3,972,460	362	3,721,360
1931	500	4,164,080	397	3,913,180
1932	510	4,093,370	383	3,665,830
1933	567	4,125,250	424	3,696,410
1934	628	4,243,033	483	3,790,593
1935	687	4,281,694	496	3,815,470
1936	682	4,399,639	503	3,971,070

J. F. Adams, G. F. Racette, Jas. A. Dunn, L. A. Potter, D. L. Frawley, H. E. Wormhoudt
Sec., Jas. A. Dunn
Treas., C. E. Votrian
Gen. Mgr., F. E. Holsten
Supts., G. T. Granger, Okmulgee, Okla., V. R. Oakley, Barnsdall, Okla.; Frank S. Horne, Wichita, Kans.
Asst. Supt., J. V. Brazier, Barnsdall, Okla.
Tank Car and Station S. M., J. F. Adams
Ch. Chem., E. R. Wiles
Pur. Agt., C. E. McClatchey
Traf. Mgr., R. E. Stewart
Refineries located at Okmulgee, Okla.; Barnsdall, Okla., and Wichita, Kans.

Basin Refining Co., Box 96, Aztec, N. Mex.
Owner, D. J. Lingenfelter
Refinery located at Aztec, N. Mex.

Bayou State Oil Corp., 1008 Slattery Bldg., Shreveport, La.
Pres., Paul M. Brown, Jr.
V. P., Sidney M. Cook
Sec. and Treas., Frank M. Cook
Supt., T. N. Reed
Tank Car S. M., Douglas MacDonald
Ch. Egr., T. N. Reed
Pur. Agt., F. D. Coons
Traf. Mgr., F. D. Coons
Refinery located at Hosston, La.

Beacon Oil & Refining Co., Henderson, Tex.
Pres., T. P. Cannon
V. P., Mrs. Alice M. Roberts
Sec., T. A. Garnett
Treas. and Gen. Mgr., T. P. Cannon
Gen. Supt., L. H. Barbee
Tank Car S. M., Mrs. E. H. Graves
Station S. M., Bob McWilliams
Refinery located at Henderson, Tex.

Bell Oil & Gas Co., Philtower Bldg., Tulsa, Okla.
Pres., S. L. Lubell
V. P.s, Albert Finston, I. A. Anson and M. L. Freese
Sec. and Treas., Benedict I. Lubell
Gen. Mgr., Albert Finston
Gen. Supt., Rex Young
Asst. Supt., C. V. Oder
Tank Car S. M., L. H. Deatherage
Ch. Egr., C. V. Oder
Ch. Chem., Grant Jarrell
Pur. Agt., J. H. Naron
Traf. Mfr., C. E. Cadieux
Refinery located at Grandfield, Okla.

Bell View Oil Syndicate, 526 Richfield Oil Bldg., Los Angeles, Calif.
Refinery located at Santa Fe Springs, Calif.

Bennett Refining Co., 2406 Esperson Bldg., Houston, Tex.
Pres., F. W. Bennett
V. P., Geo. Arnold, Jr.
Gen. Mgr., Harvey Campbell
Gen. Supt., J. H. Siedle
Tank Car. S. M., R. Hepworth
Station S. M., W. C. Lewis
Ch. Egr., H. R. Smith
Ch. Chem., Boyd Carter
Pur. Agt., F. Austin
Traf. Mgr., Roy Stewart

Berry Asphalt Co., 6 North Michigan Ave., Chicago, Ill.
Pres., B. H. Roberts
V. P., H. B. Pullar
Sec. and Treas., A. H. Anderson
Gen. Mgr., H. B. Pullar
Supt., A. T. Van Pelt
Asst. Supt., R. A. Chubb
Tank Car S. M., H. B. Pullar
Ch. Egr., J. W. Smith
Ch. Chem., F. R. Grant
Traf. Mgr., S. H. Giesy
Refinery located at Waterloo, Ark.

Berry, James B., Sons' Co., Inc., Oil City, Pa. (Subsidiary of Quaker State Oil Refining Corp.)
Pres., James D. Berry
V. P., S. Messer
Sec. and Treas., Chas. D. Berry
Gen. Supt., G. B. Hunter
Tank Car S. M., Frank Berry
Refinery located at Oil City, Pa.

REFINERY OPERATIONS IN THE UNITED STATES SEGREGATED ACCORDING TO PLANT LOCATION

State—	No. of plants	Daily crude capacity (bbls.)	No. of plants operating	Crude capacity operating plants	No. of plants shut down	Crude capacity plants shut down
Alabama	1	6,000	...	.....	1	6,000
Arizona	1	1,000	...	.....	1	1,000
Arkansas	11	49,750	6	37,500	5	12,250
California	85	900,090	70	852,990	15	47,100
Colorado	8	6,890	6	6,330	2	560
Delaware	1	2,000	1	2,000	...	.....
Georgia	2	9,000	2	9,000	...	.....
Illinois	14	134,400	11	123,200	3	11,200
Indiana	8	198,450	6	195,350	2	3,100
Iowa	1	1,500	...	.....	1	1,500
Kansas	26	175,200	24	171,200	2	4,000
Kentucky	15	37,850	11	28,950	4	8,900
Louisiana	19	219,650	14	199,750	5	19,900
Maryland	4	62,000	3	55,000	1	7,000
Massachusetts	2	48,000	2	48,000	...	.....
Michigan	17	47,200	17	47,200	...	.....
Mississippi	1	1,500	...	.....	1	1,500
Missouri	2	18,000	2	18,000	...	.....
Montana	31	37,045	24	27,465	7	9,580
Nebraska	1	75	1	75	...	.....
New Jersey	9	268,500	8	263,500	1	5,000
New Mexico	12	11,350	9	7,050	3	4,300
New York	6	56,700	6	56,700	...	.....
Ohio	17	117,245	14	113,745	3	3,500
Oklahoma	63	340,020	40	273,320	23	66,700
Pennsylvania	48	312,550	38	290,900	11	21,650
Rhode Island	2	11,000	2	11,000	...	.....
South Carolina	1	6,500	1	6,500	...	.....
South Dakota	1	100	1	100	...	.....
Tennessee	2	1,000	...	.....	2	1,000
Texas	230	1,238,140	155	1,052,995	75	185,145
Utah	4	8,600	3	8,400	1	200
Virginia	1	2,000	1	2,000	...	.....
Washington	2	1,500	...	.....	2	1,500
West Virginia	6	18,500	5	16,000	1	2,500
Wyoming	28	50,334	22	46,850	6	3,484
Total	682	4,399,639	503	3,971,070	178	428,569

Big West Oil Co. of Montana, 617 Hutton Bldg., Spokane, Wash.
Pres., L. R. Hawley
V. P.s, Chas. P. Lund, T. D. Fobes
Sec. and Treas., John E. Orr
Asst. Sec. and Treas., M. D. Prince
Gen. Mgr., L. R. Hawley
Gen. Supt., George Engle
Asst. Supt., L. J. Williams
Mgr. Sales Prom., R. I. Kerr
Tank Car and Station S. M., Amed Soderstrom
Ch. Chem., Dan Mullady
Pur. Agt., George Engle
Traf. Mgr., George Engle
Refinery located at Kevin, Toole County, Mont.

Black Gold Refining Co., 604 Commerce Exchange Bldg., Oklahoma City, Okla.
Pres. and Gen. Mgr., A. M. Edmiston
Gen. Supt., A. M. Edmiston
Sec., C. W. Scott
Treas., C. H. Marshall
Tank Car S. M., C. W. Scott
Station S. M., C. H. Hunter
Ch. Chem., Fred Irby
Pur. Agt., A. M. Edmiston
Traf. Mgr., C. H. Marshall
Refinery located at Oklahoma City, Okla.

Bluebonnett Oil Refining Co., 1509 Magnolia Bldg., Dallas, Tex.
Pres., B. L. Wooley
V. P., B. W. Wooley
Sec., C. R. McClennahan
Gen. Supt., Osborn Ellis
Tank Car S. M., B. W. Wooley
Refinery located at Wickett, Tex.

Blue Diamond Refining Co., Gladewater, Tex.
Owner, C. D. Archer
Refinery located at Gladewater, Tex.

Bowling Green Refining Co., Inc., Bowling, Green, Ky.
Pres., Ben F. Medley
V. P. and Gen. Mgr., A. C. Deer
Sec., H. T. Downing
Treas., M. A. Arvin
Supt., H. G. Taggart
Tank Car S. M., A. M. Causey
Traf. Mgr., T. C. Ridge, 1604 Heyburn Bldg., Louisville, Ky.
Refinery located at Memphis Junction, Ky.

Bradford Oil Refining Co., Bradford, Pa.
Pres., J. H. Rose
V. P., F. D. Korner
Sec. and Treas., H. G. Barcroft
Gen. Mgr., John P. Andrews
Gen. Supt., Howard Salisbury
Tank Car and Station S. M., H. C. Loveless
Ch. Egr., F. J. Steckmeyer
Ch. Chem., Arthur Barrett
Traf. Mgr., D. R. Hennessy
Refinery located at Bradford, Pa.

Bradford Penn Refining Corp., Clarendon, Pa.
Pres., Forest D. Dorn
V. P., A. D. David
Sec. and Treas., R. J. Brennan
Gen. Mgr., A. D. David
Supt., Frank L. Herle
Tank Car S. M., E. E. Hawley
Ch. Chem., W. A. Johnston
Traf. Mgr., S. L. Meyer
Refinery located at Clarendon, Pa.

Bradley Refining Co., Kilgore, Tex.
Owner, A. J. Adams
Refinery located at Kilgore, Tex.

Bush, R. R., Oil Co., 2790 Cherry Ave., Long Beach, Calif.
Pres., R. R. Bush
V. P., W. H. Morgan
Sec. and Treas., Neil Enseh
Gen. Mgr., W. H. Morgan
Gen. Supt., William E. Snowden
Sales Mgr., D. B. O'Neill
Ch. Chem., P. S. Bessor
Pur. Agt., G. N. Crowther
Refinery located at Long Beach, Calif.

C

C. & H. Refinery, Lusk, Wyo.
Partnership, Roy Chamberlain and James Hoblit
Refinery located at Lusk, Wyo

C. L. & W. Refining Co., Gladewater, Tex.
Owner, T. E. Patten
Refinery located at Gladewater, Tex.

Calcul Refining Co., Gladewater, Tex.
Owner, L. B. Culberson
Refinery located at Gladewater, Tex.

California Refining Co., 500 Coast Hi-Way, Seal Beach, Calif.
Pres., L. E. Shepard
V. P., L. L. Lack
Sec., M. B. Pendleton
Gen. Mgr. and Pur. Agt., R. Hildebrand
Gen. Supt., W. J. Cole
Refinery located at Seal Beach, Calif.

Calumet Refining Co., 4323 South Western Blvd., Chicago, Ill.
Pres., P. B. Flynn
V. P. and Gen. Mgr., T. A. Telfer
Sec. and Treas., R. S. Watt
Supt., C. A. Harris
Ch. Chem., M. B. Jester
Traf. Mgr., Geo. F. Runj
Refinery located at Burnham, Ill.

Cameron, J. D., Refinery, P. O. Box 973, Bakersfield, Calif.
Owner, J. D. Cameron
Refinery located at Taft, Calif.

Caminol Co., Ltd., 112 West Ninth St., Los Angeles, Calif.
Pres., C. R. Colby
V. P., R. E. Hines
Sec., Thomas H. Lipps
Asst. Sec., Clifford Hancock
Gen. Mgr., R. E. Hines
Gen. Supt., R. C. Colvin
Supts., Dave Lewis, Santa Fe Springs, Calif., C. L. Davies, Hanford, Calif.
Tank Car S. M., J. M. McElwain
Station S. M., Clifford Hancock
Ch. Egr., R. C. Colvin
Ch. Chem., S. J. Garrett
Pur. Agt., Wm. Wells
Traf. Mgr., J. M. McElwain
Refineries located at Santa Fe Springs, Calif., and Hanford, Calif.

Canfield Oil Co., 3216 East Fifty-fifth St., Cleveland, Ohio
Pres., Louis Carruth
V. P., Charles McLean
Sec., H. M. Carruth
Treas., J. A. Jackson
Supts., R. W. Helm, Coraopolis, Pa.; A. C. Minch, Cleveland, Ohio
Tank Car S. M., John R. Nelson
Ch. Egr. and Chem., Louis W. Hodous
Pur. Agt., M. C. Dippel
Traf. Mgr., J. T. Mullaney
Refineries located at Coraopolis, Pa., and Cleveland, Ohio

Canyon Oil & Gas Co., Cisco, Tex.
Pres., Tom Bryant
V. P., A. E. Bryant
Sec. and Treas., R. Elliott Bryant
Gen. Supt., M. V. McConathy
Sales Mgr., M. V. McConathy
Pur. Agt. and Traf. Mgr., R. E. Bryant
Refinery located at Cisco, Tex.

Capitol Crude Oil Co., 1020 Subway Terminal Bldg., Los Angeles, Calif.
Pres., E. P. Clark
Refinery located at Santa Paula, Calif.

Carbide & Carbon Chemicals Corp., 30 East Forty-second St., New York, N. Y.

Pres., J. A. Rafferty
V. P.s, G. O. Curme, Jr., J. G. Davidson, J. W. McLaughlin, H. E. Thompson, R. W. White
Sec., A. C. Cornell
Treas., C. T. Ayres
Works Mgr., G. B. Landes
Supt., C. S. Heath, S. Charleston, W. Va.
Sales Mgr., W. F. Reich, Jr.
Ch. Egr., C. S. Heath
Ch. Chem., G. V. Scofield
Pur. Agt., W. S. Ackerman
Refinery located at South Charleston, W. Va.

Carpenter, Terry, Refinery, Scottsbluff, Nebr.

Sole owner, Terry Carpenter
Ch. Egr., Joe Jinks
Ch. Chem., Mr. Wilson
Refinery located at Scottsbluff, Nebr.

Carson, M. D., Refinery, Brady, Tex.

Sole owner, M. D. Carson
Ch. Egr. and Chem., J. M. Carson
Refinery located at Brady, Tex.

Casmite Co., 111 West Seventh St., Los Angeles, Calif.

Pres., O. C. Freed
V. P., J. C. Burks
Sec., N. J. Hale
Treas., R. B. Hale
Gen. Supt., Art Young
Refinery located at Casmalia, Calif.

Century Refining Co., Merchants Bldg., Alma, Mich.

Pres. and Gen. Mgr., John F. Martin
V. P., Fred Morgan
Sec. and Treas., I. C. Bradbury
Gen. Supt., A. F. Zoll
Tank Car and Station S. M., M. D. Wenderly
Ch. Egr., A. F. Zoll
Refinery located at Alma, Mich.

Century Refining Co., Friars Switch, Tex.

Owners, J. C. Wynne, J. I. Staley, C. A. Middleton and C. E. Middleton
Refinery located at Friars Switch, Tex.

Chalmette Petroleum Corp., 1904 American Bank Bldg., New Orleans, La.

Pres., B. C. McClellan
Exec. V. P., D. B. Williams
V. P.s, Charles Leftwich, C. D'Antoni
Sec. and Treas., R. P. Batson
Gen. Mgr., D. B. Williams
Supt., J. C. Senter, Chalmette, La.
Asst. Supt., H. H. Long, Chalmette, La.
Sales Mgr., M. Besselman
Ch. Egr., J. C. Senter
Ch. Chem., L. P. McCurnin
Pur. Agt., V. G. McPherson
Traf. Mgr., J. E. Loper
Refinery located at Chalmette, La.

Champlin Refining Co., Enid, Okla.

Pres., H. H. Champlin
V. P., Joe N. Champlin
Sec. and Treas., D. W. Cotton
Asst. Sec. and Treas., G. Wilkenson
Gen. Supt., E. J. Slater
Tank Car S. M., L. A. Snyder
Station S. M., A. H. Holland
Ch. Egr., R. L. Clifton
Pur. Agt., L. E. Noble
Traf. Mgr., J. L. Morgan
Refinery located at Enid, Okla.

Chief Refining, Inc., Gladewater, Tex.

Pres., H. C. Haberle
V. P., Mrs. L. B. Haberle
Sec. and Treas., L. B. Haberle
Gen. Supt., B. J. Moreau
Tank Car S. M., Ray Hurmans
Ch. Chem., F. R. Purvis
Pur. Agt., B. J. Moreau
Traf. Mgr., Ray Hurmans
Refinery located at Gladewater, Tex.

Cities Service Refining Co., 260 Tremont St., Boston, Mass. (Subsidiary Cities Service Co.)

Pres., F. R. Coates
V. P.'s, W. A. Jones, Harry D. Frueauff, 60 Wall St., New York; J. S. Cordell, H. O. Caster, T. I. Carter
Sec., J. V. Koons
Treas., E. H. Johnston
Gen. Mgr., John S. Cordell
Gen. Supt., L. M. Bound
Supt., D. P. Sturges, East Braintree, Mass.
Asst. Supt., L. A. Besselman
Tank Car S. M., J. A. Kelley
Station S. M., T. J. Spellman
Ch. Egr., A. P. Nelson, East Braintree, Mass.
Ch. Chem., A. H. Alden, East Braintree, Mass.
Pur. Agt., C. L. Boyle
Traf. Mgr., W. A. Hamel
Refinery located at East Braintree, Mass.

Citizens Oil & Refining Corp., Box 168, Luling, Tex.

Pres., Abner Ussery
V. P.s, R. E. Goode, A. L. Corcoran
Sec. and Treas., H. J. Mayton
Gen. Mgr., R. E. Goode
Sales Mgr and Pur. Agt., H. J. Mayton
Ch. Chem., Herbert Benner
Refinery located at Luling, Tex.

Cole, L. S., Refining Co., Box 108, Oklahoma City, Okla.

Owner, L. S. Cole
Refinery located at Oklahoma City, Okla.

Colonial Beacon Oil Co., Inc., 285 Columbus Ave., Boston, Mass. (Subsidiary of Standard Oil Co. of New Jersey)

Pres., A. Clarke Bedford
V. P., E. N. Wrightington
Sec. and Treas., E. N. Wrightington
Gen. Mgr., P. C. Shea
Gen. Supt., W. Naden
Tank Car S. M., J. C. Ritchie
Bulk S. M., T. H. Taylor
Ch. Egr., H. L. Bolton
Ch. Chem., J. F. Marr
Pur. Agt., Geo. Clark
Traf. Mgr., J. H. Gies
Refinery located at Everett, Mass.

Col-Tex Refining Co., Ramsey Tower, Oklahoma City, Okla.

Pres., L. H. Prichard
V. P., J. Steve Anderson
Sec. and Treas., Paul H. Anderson
Gen. Supt., George H. Burruss, Oklahoma City, Okla.
Supt., E. H. Gunn, Colorado, Tex.
Tank Car and Station S. M., C. L. Mayhall
Ch. Egr., George H. Burruss
Pur. Agt., William Sturges
Traf. Mgr., M. H. Champion
Refinery located at Colorado, Tex.

Concho Refining Co., Box 79, San Angelo, Tex.

Pres., R. D. Lavery
V. P.s, Owen F. McGee, James Farrel
Refinery located at San Angelo, Tex.

Condor Refining Co., Kilgore, Tex.

Owner, Brown McKellum
Refinery located at Kilgore, Tex.

Conewango Refining Co., Market St. Ext., Warren, Pa.

Pres., Harry R. Lewis
Sec. and Treas., H. B. Goetz
Supt., W. L. Gettings
Ch. Egr., A. Gohn
Ch. Chem., R. S. Dawson
Tank Car S. M., K. M. Lyons
Pur. Agt., Tom Moore
Refinery located at Warren, Pa.

Conrad Refining Co., Conrad, Mont.

Pres., Perry L. Withers
V. P., E. H. Withers
Sec. and Treas., D. L. Simon
Gen. Mgr., Perry L. Withers
Supt., Ellsworth Withers, Conrad, Mont.
Sales Mgr., Perry L. Withers
Refinery located at Conrad, Mont.

Conroe Oil & Refining Co. (Grank Lake), Conroe, Tex.

Pres., A. N. Munhall
V. P., Thos. Kehoe
Sec. and Treas., W. J. Pfiffner
Supt., A. N. Munhall
Refinery located at Conroe, Tex.

Consolidated Refining Co., Gladewater, Tex.

Owner, George L. Culver
Refinery located at Gladewater, Tex.

Consumers Refining Co., Conrad, Mont.

Same offices as Conrad Refining Co.
Refinery located at Collins, Mont.

Continental Oil Co., Ponca City, Okla.

Pres., Dan Moran
V. P.s, W. H. Ferguson, W. W. Bruce, Walter Miller, R. E. Collom
Sec., James J. Cosgrove
Treas., G. F. Smith
V. P. in Chg. Mfg., Walter Miller
Mfg. Mgr., Harold K. Osborn
Supts., Fred G. Fellows, Ponca City, Okla.; J. W. Brown, Baltimore, Md.; D. H. Hyler, Wichita Falls, Tex., George Smee, Florence, Colo.; C. R. Tillman, Glenrock, Wyo.; C. V. Coulson, Farmington, N. Mex.; Charles Morgan, Artesia, N. Mex.; J. E. Fenex, Denver, Colo.; H. H. Kinnaird, Albuquerque, N. Mex.; L. L. Smith, Lewistown, Mont.
Asst. Supts., J. O. Thoen, Ponca City, Okla.; W. M. Cocke, Baltimore, Md.; R. H. Main, Glenrock, Wyo.
Gen. Sales Mgr., H. J. Kennedy
Ch. Egr., M. E. Clawson
Ch. Chem., B. H. Lincoln
Pur. Agt., W. H. O'Connor
Traf. Mgr., P. H. Kuhns
Refineries located at Ponca City, Okla.; Baltimore, Md.; Sapulpa, Okla.; Wichita Falls, Tex.; Florence, Colo.; Glenrock, Wyo.; Farmington, N. Mex.; Denver, Colo.; Albuquerque, N. Mex.; Lewistown, Mont.; Artesia, N. Mex.

Continental Refining Co., P. O. Box 175, Oil City, Pa.

Pres., Thos. A. Anderton
V. P., M. A. DeArman
Sec., S. S. DeArman
Treas., J. W. Anderton
Gen. Mgr., Thos. A. Anderton
Supt., I. L. Klein
Asst. Supt., J. Vogan
Tank Car and Sta. S. M., C. F. Felton
Ch. Chem., E. F. Hanna
Pur. Agt., H. Wiley
Traf. Mgr., D. C. Hasson
Refinery located at Oil City, Pa.

Corpus Christi Refining Corp., Taylor, Tex.

Pres., G. L. Rowsey
V. P., J. F. Whitehurst
Sec., Harris Melasky
Treas., Ben H. Harrison
Gen. Mgr., G. L. Rowsey
Gen. Supt., J. F. Whitehurst
Asst. Supt., G. R. Whitener, Corpus Christi, Tex.
Ch. Chem., C. A. Cromwell
Pur. Agt., J. F. Whitehurst
Refinery located at Corpus Christi, Tex.

Cosden Oil Corp., 1700 Electric Bldg., Fort Worth, Tex.

Temporary Trustee, W. D. Richardson
Pres., J. S. Cosden
V. P.s, W. D. Richardson, A. G. Reed
Asst. Sec., W. D. Richardson
Asst. Treas., A. G. Reed
Gen. Mgr., W. D. Richardson
Supt., E. Potter, Big Spring, Tex.
Asst. Supt., J. L. LeBleu
Tank Car and Station S. M., W. D. Richardson
Ch. Egr., W. J. Darby
Ch. Chem., E. W. Richardson
Pur. Agt., E. E. Brogden
Traf. Mgr., Walker Wilson
Refinery located at Big Spring, Tex.

Crew-Levick Co., 400 North Broad St., Philadelphia, Pa. (Subsidiary of Cities Service Co.)

Pres., Henry L. Doherty, New York, N. Y.
V. P.s, Chas. E. Foster, George W. Hawkins
Sec., A. R. Thorson
Treas., Walter W. Martin
Gen. Mgr., Charles E. Foster
Gen. Supt., J. W. Griswold
Supts., E. M. Keely, Petty Island, N. J.; C. E. Kinder, Titusville, Pa.
Asst. Supts., A. P. Frame, Petty Island, N. J.; A. F. Anderson, Titusville, Pa.
Gen. S. M., George W. Hawkins
Tank Car S. M., H. C. Gibson
Mgr. Wholesale Dept., A. H. Irelan
Mgr. Retail Sales Dept., C. R. Johnson
Ch. Lab. Egr., G. B. Staples
Ch. Chem., E. F. Burch, Petty Island, N. J.
Control Lab., W. N. Westcott
Pur. Agt., E. D. Erney
Traf. Mgr., H. P. Ross
Oper. Dept. Mgr., E. C. Mackey
Refineries located at Petty Island, N. J., and Titusville, Pa.

Cross, Henry H., Co., 122 South Michigan Ave., Chicago

Pres., H. H. Cross
V. P., Geo. F. Fox
Sec., L. L. Dent
Supts., Geo. Hovell, Smackover, Ark.; J. L. McAndrew, Dupo, Ill.; W. A. Moody, Joliet, Ill.; D. L. Crandall, Colmar, Ill.
Refineries located at Smackover, Ark.; Dupo, Ill.; Colmar, Ill., and Joliet, Ill.

Crown Central Petroleum Corp., American Bldg., Baltimore, Md.

Pres., Henry A. Rosenberg
V. P., H. S. Lane
Sec., James T. B. Bowles
Treas., S. K. Waters
Gen. Supt., K. W. Shimeal
Supt., R. F. Myers
Gen. Sales Mgr., Jesse Stickel
Traf. Mgr., F. C. Clark
Ch. Chem., H. J. Sheard
Pur. Agt., Paul Smith
Mgr. of Crude Purch., Walter Rawlins.
Refinery located at Pasadena (near Houston), Tex.

Crystal Oil Works, Oil City, Pa.

Partners, J. A. Fawcett, E. V. Selden
Gen. Supt., W. B. Graham
Refinery located at Rouseville, Pa.

Crystal Refining Co., Kilgore, Tex.

Owner, Frank Reardon
Refinery located at Kilgore, Tex.

Crystal Refining Co. of Carson City, Inc., Carson City, Mich.

Pres., Delbert Fortney
V. P.s, E. G. Guy, J. G. Fleckenstein
Sec. and Treas., M. A. Hagerman
Supt., E. G. Guy
Asst. Supt., C. B. Johnson
Sales Mgr., J. G. Fleckenstein
Asst. Sales Mgr., K. M. Lindemann
Ch. Egr., C. B. Johnson
Refinery located at Carson City, Mich.

Culver Refining Co., Gladewater, Tex.

Owner, George L. Culver
Refinery located at Gladewater, Tex.

Cusco Oil & Refining Co., Chase, Kans.

Pres., I. W. Siegel
Sec. and Treas., F. H. Unruh
Gen. Mgr., Ben Taxman
Gen. Supt., Jesse F. Hughes
Tank Car S. M., Ben Taxman
Refinery located at Chase, Kans.

Cushing Refining & Gasoline Co., Cushing, Okla.

Pres., E. C. Mullendore
V. P., Rex H. Winget
Sec., M. E. James
Treas., R. C. Jones
Gen. Mgr., Rex H. Winget
Gen. Supt., J. H. Hutchinson
Supts., F. A. Davis, Cushing, Okla.; F. C. Hutchinson, Blackwell, Okla.

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Makers of Yale Hand and Electric Chain Hoists, Trolleys, Electric Trucks, Hand Lift Trucks and Skid Platforms

Cracking Supt., H. A. Booker
Asst. Supt., W. L. Nichols, Blackwell, Okla.
Traf. Mgr., M. E. James
Tank Car S. M., E. O. Derrick
Ch. Chem., T. M. Lumly, Jr.
Refineries located at Cushing, Okla., and Blackwell, Okla.

Cut Bank Refining Co., Cut Bank, Mont.
Pres., K. H. Davis
V. P., R. C. Tarrant
Sec. and Treas., J. A. Strack
Gen. Mgr., K. H. Davis
Supt., Howard Lynn
Refinery located at Cut Bank, Mont.

D

Danciger Oil & Refineries, Inc., Hunt Bldg., Tulsa, Okla.
Pres. and Gen. Mgr., Dan Danciger
V. P.s, A. Danciger and Joe Danciger
Sec., J. E. Vaeth
Treas., Joseph Danciger
Gen. Supt., M. R. Ryan
Supts., Fred E. Shryock, Pampa, Tex.; A. W. McAllister, Bodie, Tex.
Tank Car S. M., Leo R. Brammer
Ch. Egr., M. R. Ryan
Ch. Chem., Lysle Owen
Pur. Agt., Jay Hausam
Traf. Mgr., R. R. Maines
Refineries located at Pampa, Tex., and Bodie, Tex.

W. H. Daugherty & Son Refining Co., 88 Lexington Ave., New York (Subsidiary of L. Sonneborn Sons, Inc.)
Pres., Dr. Ferdinand Sonneborn
V. P., J. F. Roten
Sec., R. G. Sonneborn
Treas. and Gen. Mgr., Max Pick
Mgr., T. M. Murphy
Ch. Chem., Dr. F. W. Breth
Refineries located at Petrolia, Pa., and Franklin Creek, Pa.

Deep Rock Oil Corp., Atlas Life Bldg., Tulsa, Okla.
Trustee, H. N. Greis
Ref. Mgr., W. E. Moody
Supt., Geo. Waltershausen, Cushing, Okla.
Tank Car and Station S. M., W. J. Carthaus, Chicago, Ill.
Ch. Egr., R. G. Davis, Cushing, Okla.
Ch. Chem., B. Frichot, Cushing, Okla.
Pur. Agt., R. G. Martin
Traf. Mgr., B. J. Burchett, Chicago, Ill.
Refinery located at Cushing, Okla.

Deep Water Oil Refineries, Inc., First National Bank Bldg., Houston, Tex.
Pres., F. M. Law
V. P., E. L. Neville
Sec. and Treas., E. L. Neville
Gen. Mgr., J. W. Painter
Refinery located at Houston, Tex.

Denver Refining Syndicate, 1225 Twelfth St., Denver, Colo.
Partners, J. D. Cook and L. E. Smith
Refinery located at Denver, Colo.

Derby Oil Co., 352 N. Broadway, Wichita, Kans.
Chm. Br., A. L. Derby
Pres., Berkeley Williams
V. P.s, E. C. Moriarity, F. W. McCurry
Sec., E. Wasser
Treas., E. C. Claiborn
Gen. Mgr., A. L. Derby
Gen. Supt., F. W. McCurry
Supt., Martin Ettington
Tank Car S. M., C. A. Keller
Station S. M., C. A. Clark
Ch. Chem., Geo. Webber
Pur. Agt., R. E. Cowen
Traf. Mgr., H. G. Watts
Refinery located at Wichita, Kans.

Diamond Oil Co., 304 Vermont Bldg., Salt Lake City, Utah
Pres., John Shewel
Sec. and Treas., Seymour B. Hagen
Gen. Supt., J. L. Andrus, Virgin, Utah
Ch. Egr., C. W. Buskirk
Refinery located at Virgin, Utah

Dickey Refining Co., Wichita, Kans.
Pres., Geo. P. Dickey
Sec. and Treas., H. Dungan
Gen. Mgr., A. M. Ballard
Gen. Supt., Carl O. Orrison
Tank Car and Station S. M., A. M. Ballard
Ch. Chem., E. Martin
Refinery located at McPherson, Kans.

Dixie Oil & Refining Co., Inc., Jackson, Mich.
Pres., Ed H. Condon
V. P., Earl T. Moor
Sec. and Treas., H. Grady Graham
Gen. Mgr., E. H. Condon
Gen. Supt., W. F. Mitchell
Refinery located at Jackson, Miss.

Dunlap Refinery, Cat Creek, Mont.
Sole owner, W. F. Dunlap
Refinery located at Cat Creek, Mont.

E

Eagle Oil & Refining Co., 3328 Elm Ave., Long Beach, Calif.
Pres. and Gen. Mgr., E. A. Edminston
Refinery located at Santa Fe Springs, Calif.

Eason Oil Co., Bass Bldg., Enid, Okla.
Pres., T. T. Eason
V. P., L. D., Hinman
Sec. and Treas., T. W. Eason
Gen. Mgr., T. T. Eason
Supt., P. G. Maranville
Tank Car S. M., R. H. Rowland
Station S. M., J. D. Montgomery
Ch. Egr., W. H. Taft
Ch. Chem., G. B. Lyon
Pur. Agt., A. C. Hatton
Traf. Mgr., E. B. Sinclair
Refinery located at Enid, Okla.

East Texas Refining Co., 1405 Tower Petroleum Bldg., Dallas, Tex.
Pres., F. W. Burford
V. P., John J. Thomas
Sec., R. E. Bishop
Treas., E. V. Campbell
Gen. Mgr., John J. Thomas
Tank Car S. M., Ralph E. Bishop
Station S. M., H. C. Goettig
Pur. Agt., W. M. Bisett
Traf. Mgr., A. L. Heine
Refineries located at Longview, Tex.

Eclipse Oil & Refining Co., Inc., Newcastle, Wyo.
Pres., B. V. Hole, Jr.
V. P., Lenard Shell
Sec. and Treas., Lewis Arney
Gen. Mgr. and Pur. Agt., Lenard Shell
Gen. Supt., Lenard Shell
Refinery located at Newcastle, Wyo.

Edington Oil & Refining Co., Ltd., 2800 Cherry Ave., Long Beach, Calif.
Pres., C. B. Edington
V. P.s, A. M. Lovelace, L. A. Foulger
Sec., A. C. Edington
Treas., C. B. Edington
Gen. Supt., L. A. Foulger
Asst. Supt., Frank Wolgemuth
Station S. M., C. B. Edington
Refinery located at Long Beach, Calif.

Egasco Operating Co., Box 428, Osage, Wyo.
Pres., Albert E. May
V. P., E. E. Wakeman
Sec. and Asst. Treas., A. F. Lesley
Treas., Harry A. May
Refinery located at Osage, Wyo. Operating part time.

El Dorado Refining Co., National Bank Bldg., El Dorado, Kans.
Pres., Charles G. Yankey, Wichita, Kans.
V. P., Robert H. Hazlett
Sec., T. A. Helling
Treas., Robert H. Bradford
Gen. Mgr., T. A. Helling
Supt., G. C. Anderson
Asst. Supt., H. J. Datin
Tank Car S. M., C. W. Rice
Station S. M., C. A. Elmborg
Pur. Agt., O. G. Jackson
Traf. Mgr., R. E. Fisher
Refinery located at El Dorado, Kan.

Elk Refining Co., Kanawha Valley Bank Bldg., Charleston, W. Va.
Pres., H. A. Logan
V. P. and Treas., F. G. Bannerot, Sr.
Sec., F. G. Bannerot, Jr.
Gen. Mgr., R. D. Lowe
Supt., Robert Burr., Falling Rock, W. Va.
Asst. Supt., C. J. Hesch, Falling Rock
Tank Car S. M., C. V. Harner
Station S. M., John W. Wright
Ch. Chem., F. A. Nicholson
Pur. Agt., E. B. Hamilton
Traf. Mgr., L. K. Forthman
Refinery located at Falling Rock, W. Va.

Elm Oil Co., Ltd., 3328 Elm Ave., Long Beach, Calif.
Pres., Fred Steiner
Sec., G. Kindseth
Refinery located at Long Beach, Calif.

Empire Oil & Refining Co., Bartlesville, Okla. (Subsidiary of Cities Service Co.)
Pres., H. L. Doherty
V. P.s, Frank R. Coates, H. R. Straight, H. D. Frueauff, A. W. Ambrose, W. A. Jones
Sec., C. E. Murray
Treas., Lloyd Lynd
Gen. Mgr., P. M. Miskell
Gen. Supt., H. W. Camp
Supts., Edward H. Roy, East Chicago, Ind.; Curtis O. Bailey, Gainesville, Tex.; Don V. Eells, Okmulgee, Okla.; Lee Haugen, Ponca City, Okla.
Tank Car S. M., O. J. Tuttle
Station S. M., W. H. Merritt
Ch. Egr., Clay Briggs
Ch. Chem., W. W. Scheuman
Pur. Agt., G. A. Tompson
Traf. Mgr., A. C. Holmes
Refineries located at East Chicago, Ind., Gainesville, Tex.; Okmulgee, Okla.; Ponca City, Okla.; Cushing, Okla.

Envoy Petroleum Co., 300 Walnut St., Long Beach, Calif.
Pres., A. M. Lockhart
V. P., Harry J. Witz
Sec., Wm. S. Wilsey
Treas., A. M. Lockhart
Gen. Supt., Wm. F. Emory
Asst. Supt., W. A. Shaeffer
Tank Car and Station S. M., A. M. Lockhart
Ch. Chem., W. A. Shaeffer
Pur. Aft. and Traf. Mgr., W. S. Wilsey
Refinery located at Long Beach, Calif.

Estado Petroleum Corp., Ltd., 1315 East Hill St., Long Beach, Calif.
Pres., L. Y. Mattes
V. P., E. E. Greiner
Sec. and Treas., H. Hartsock
Gen. Mgr., L. Y. Mattes
Gen. Supt., E. E. Greiner
Asst. Supt., T. G. Stickels
Ch. Chem., S. A. Blocher
Refinery located at Long Beach, Calif.

Exchange Petroleum Corp., P. O. Box 817, Albany, Tex.
Pres., A. A. Spencer
Sec. and Treas., H. A. Spencer
Gen. Mgr., A. A. Spencer
Supt., C. C. White
Asst. Supt., L. M. Woods
Tank Car S. M., A. A. Spencer
Staton S. M., W. A. Waters
Pur. Agt., H. R. Roberts
Refinery located at Albany, Tex.

Exeter Refining Co., 5843 Paramount Blvd., Long Beach, Calif.
Pres., Carl von Bibra
V. P. and Treas., Earle F. Demond
Sec., Harold E. Thomas
Ref. Mgr., N. F. Gallucci
Ch. Chem., John Klein
Refinery located at North Long Beach, Calif.

F

Falcon Refining Co., P. O. Box 773, Great Bend, Kans.
Pres., H. A. Dickson
Sec., R. W. Morris
Treas., H. A. Dickson
Gen. Mgr., H. A. Dickson
Gen. Supt., John Grubb
Supt., R. W. Russell
Tank Car S. M., M. Stayton
Station S. M., H. A. Dickson
Ch. Chem., John Grubb
Pur. Agt., O. H. Shaffer
Traf. Mgr., N. Keenan
Refinery located at Great Bend, Kans.

Falls Refining Co., Wichita Falls, Tex.
Pres., James E. Parker
V. P., H. T. Parker
Refinery located at Wichita Falls, Tex.

Fern Oil Co., Thermopolis, Wyo.
Pres., Bruce Sullivan
Sec., Richard Downing
Treas., Russell Murray
Gen. Mgr., Bruce Sullivan
Gen. Supt., D. D. Gibson
Asst. Supt., V. Domenico
Tank Car S. M., Glenn Sullivan
Station S. M., J. W. Johnson
Ch. Chem., J. E. Simon
Pur. Agt., L. A. White
Traf. Mgr., M. M. Carnes
Refinery located at Thermopolis, Wyo.

Franklin Creek Refining Corp., 88 Lexington Ave., New York City
Pres., Dr. Ferdinand Sonneborn
V. P.s, J. F. Roten, S. B. Sonneborn
Sec., R. G. Sonneborn
Treas., Max Pick
Gen. Mgr., C. H. Alsberg
Supt., C. H. Goss
Asst. Supt., D. S. Bleakley
Tank Car S. M., C. H. Alsberg
Ch. Chem., T. G. Murphy
Pur. Agt., C. H. Alsberg
Traf. Mgr., L. R. Parker
Refinery located at Franklin, Pa.

Franklin, Wirt, Petroleum Corp., Box 966, Ardmore, Okla.
Pres., Wirt Franklin
V. P., F. M. Porter
V. P. and Treas., Edward Galt
Sec. and Gen. Mgr., F. M. Porter
Station S. M., J. S. Entriken
Tank Car S. M. and Pur. Agt., C. A. Franklin
Refinery located at Ardmore, Okla.

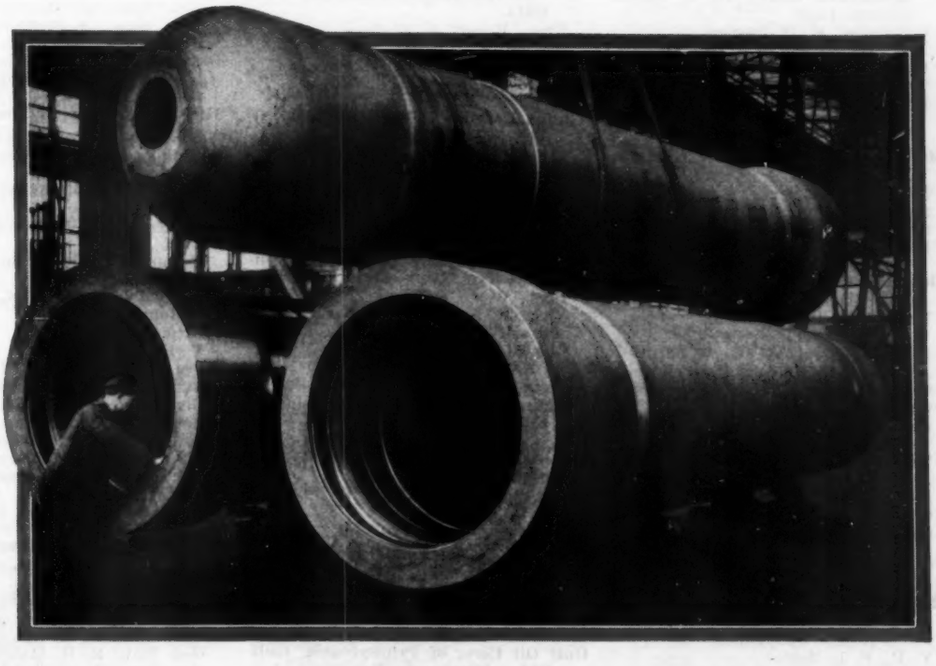
Fredonia Oil & Refining Co., Box 63, Fredonia, Kans.
Pres., D. W. Crumley, Chanute, Kans.
V. P., Mrs. Helen Daugherty, Topeka, Kans.
Sec. and Pur. Agt., Raymond Justice
Station S. M., Raymond Justice
Gen. Supt., Ira Dozier
Refinery located at Fredonia, Kans.

Freedom Oil Works Co., Freedom, Pa.
Pres., Earle M. Craig
V. P., Albert B. Craig
Sec. and Treas., C. E. McKee
Supt., B. L. Heath
Refinery S. M., R. B. McKee
Station S. M., E. N. McDonald
Ch. Chem., A. M. Crittenden
Pur. Agt., George J. Mohr
Traf. Mgr., E. W. Niehaus
Refinery located at Freedom, Pa.

Friars Topping Co., Friars Switch, Tex.
Owner, Pat Frailly
Refinery located at Friars Switch, Tex.

G

General Petroleum Corp. of California, Higgins Bldg., Los Angeles, Calif. (Subsidiary of Socony-Vacuum Corp.)
Pres., A. L. Weil
V. P.s, S. J. Dickey, R. A. Sperry, W. L. McLane, A. H. DeFriest



Seamless Hollow-Forged
Reaction Chambers

Dephlegmators and other Pressure Vessels for Cracking and Hydrogenation of Oils, Coal, Tars etc. working at the highest pressures and temperatures, made in Siemens-Martin Carbon Steel or Alloy Steels of an especially high resistance to chemical attacks. For Piping and Fittings for Cracking and Hydrogenation Plants we recommend our special Alloy Steels preventing Surface Scaling at 800° C and particularly resisting to Hydrogen Attacks and the effects of High Temperatures.

KRUPP

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Fried. Krupp Aktiengesellschaft, Essen (Germany)

Sec., D. W. Woods
Treas., W. Cunningham
Supts., Fred Isaacs, Vernon and Torrance, Calif.; R. C. Wheeler, Lebec
Asst. Supt., W. M. McElroy, Vernon and Torrance
Tank Car and Station S. M., A. H. DeFriest
Consulting Egr., S. J. Dickey
Ch. Chem., G. F. Olsen
Pur. Agt., R. M. Ketchum
Traf. Mgr., C. E. Zeigler
Refineries located at Vernon, Torrance, Lebec (all of California)

Gillette Refining Co., Sheridan, Wyo.
Pres., Charles Brittan
V. P., C. R. Carlsen
Sec. and Treas., W. F. O'Brien
Gen. Mgr., V. C. Langford
Gen. Supt., V. C. Langford
Supts., R. V. Copsey, Newcastle, Wyo.; W. F. O'Brien, Gillette, Wyo.; V. C. Langford, Sheridan, Wyo.
Asst. Supts., Geo. Culver, Newcastle, Wyo.; Ray Wright, Gillette, Wyo.; R. M. Kelley, Sheridan, Wyo.
Tank Car and Station S. M., Charles Brittan
Ch. Egr., V. C. Langford
Ch. Chem., R. M. Kelley
Pur. Agt., C. R. Carlsen
Refineries located at Newcastle, Wyo.; Gillette, Wyo., and Sheridan, Wyo.

Gilliland Refining Co., Gladewater, Tex.
Pres., J. W. Gilliland
Sec. and Treas., Albert S. Reagan

Gilmer Oil Co., Gladewater, Tex.
Owner, O. F. Tearil

Gilmore Oil Co., 2423 East Twenty-eighth St., Los Angeles, Calif.
Pres., E. B. Gilmore
V. P. and Treas., C. S. Beesemyer
V. P. and Sec., S. M. Salisbury
Gen Supt., H. L. Eggleston
Asst. Supts., Perry Vandervort, Roadamite, Calif.; H. E. Marsh, Vernon, Calif.
Ch. Chem., R. H. Pierson
Ser. Sta. S. M., B. A. Rowell
Pur. Agt., D. H. MacPherson
Traf. Mgr., J. O. Pfeiffer
Refineries located at Vernon and Roadamite, Calif.

Glasgow Oil & Refining Co., Glasgow, Ky.
Pres., R. B. Tyler
Sec. and Treas., Sewell C. Harlin
Station S. M., J. R. Richey
Refinery located at Glasgow, Ky.

Globe Oil & Refining Co., (Ill.), Box 820, Blackwell, Okla.
Pres., I. A. O'Shaughnessy
V. P., F. L. Jehle
Sec. and Treas., G. G. Woodruff
Asst. Sec. and Treas., R. E. Everitt
Gen Mgr., F. L. Jehle
Supt., H. B. Overton, Lemont, Ill.
Asst. Supt., H. D. Van Deman, Lemont, Ill.
Tank Car S. M., A. E. Landsittel, Wichita, Kans.
Asst. S. M., B. L. Meece
Ch. Egr., H. D. Van Deman
Ch. Chem., C. C. Twichell
Pur Agt., H. B. Overton
Refinery located at Lemont, Ill.

Globe Oil & Refining Co., (Kans.), Box 820, Blackwell, Okla.
Pres., I. A. O'Shaughnessy
V. P., F. L. Jehle
Sec. and Treas., J. F. O'Shaughnessy
Asst. Sec. and Treas., R. E. Everitt
Gen. Mgr., F. L. Jehle
Supt, E. J. Mary, McPherson, Kans.
Tank Carf S. M., A. E. Landsittel
Asst. S. M., Geo. C. Jehle
Ch. Chem., N. K. Hopp
Pur Agt., E. J. Mary
Traf. Mgr., R. E. Walcher
Refinery located at McPherson, Kans.

Globe Oil & Refining Co. (Okla.), Box 820, Blackwell, Okla.
Pres., I. A. O'Shaughnessy
V. P., F. L. Jehle
Sec., R. E. Everitt
Treas., E. A. Lentz
Gen. Mgr., F. L. Jehle
Supt., R. D. McCrum
Tank Car S. M., A. E. Landsittel
Asst. Sales Mgr., Geo. C. Jehle
Ch. Egr., S. P. Redfearn
Ch. Chem., A. A. Gilbert
Traf. Mgr., E. R. Walker
Pur. Agt., L. S. Coombs
Refinery located at Blackwell, Okla. shut down.

Golden Bear Oil Co., Ltd., 606 Union Bank Bldg., Los Angeles, Calif.
Pres., S. R. Roseberg
V. P., J. M. Feldman
Sec. and Treas., Louis L. Swarthe
Gen. Mgr., J. M. Feldman
Gen. Supt., Floyd D. James
Supt., Chas. P. Prewett, Oildale, Calif.
Asst. Supt., Norman Davidson, Oildale, Calif.
Refinery located at Oildale, Calif.

Golden Rule Refining Co., Wichita, Kans.
Pres., Elbert S. Rule
Sec. and Treas., Roy E. Stewart
Gen. Mgr., Elbert S. Rule
Supt., J. E. McIntyre
Tank Car and Station S. M., Roy E. Stewart
Pur. Agt., Roy E. Stewart
Refinery located at Wichita, Kans.

Goldman Refining Co., Gladewater, Tex.
Owner, Harry Goldman
Refinery located at Gladewater, Tex.

Goshen Oil Refining Co., Torrington, Wyo.
Pres., M. A. Eaton
V. P., S. J. Eaton
Sec. and Treas., Irene Eaton
Gen. Supt., E. D. Bishop
Refinery located at Torrington, Wyo.

Government Refining Co., 2109 First National Bldg., Oklahoma City, Okla.
Pres., Robert A. Wallace
Sec., K. B. Harton
Refineries located at Oklahoma City and Seminole

Gratex Refining & Fuel Oil Co., P. O. Box 307, Graham, Tex.
Pres., G. O. Cozart
Supt., W. O. Cozart
Sales Mgr. and Pur. Agt., E. R. Marchman
Refinery located at Graham, Tex.

Greenville Refining Co., Inc., Greenville, Ky.
Pres., W. C. Malone
V. P., H. E. Eaves, Sr.
Sec. and Treas., H. E. Eaves, Jr.
Gen. Mgr., B. L. Andrews
Sales Mgr., H. E. Eaves, Jr.
Pur. Agt., H. E. Eaves, Jr.
Refinery located at Greenville (Muhlenberg County), Ky.

Griswold Refineries, Box 1364, Shreveport, La.
Owner and Gen. Mgr., E. F. Griswold
Treas., J. A. Bowden
Gen. Supt., C. L. Hilgenfeld
Asst. Supt., E. S. Stephenson
Tank Car S. M., E. F. Griswold
Refineries located at Shreveport and Sandra, La.

Gulf Oil Corp. of Pennsylvania, Gulf Bldg., Pittsburgh, Pa.
Pres., J. F. Drake
V. P.s, Chas. B. Buerger, W. V. Hartmann, H. A. Gidney, B. P. Newton
Sec., W. J. Guthrie
Treas., J. E. Nelson
Gen. Mgr., Wm. A. Slater
Mgr. Ref., H. V. Sanderson, Staten Island, N. Y.
Supts., T. J. Sullivan, Port Arthur, Tex.; Herman Taylor, Fort Worth, Tex.; T. F. Hogan, Sweetwater, Tex.; W. M. Crockett, Philadelphia, Pa.; W. M. Braybrooks, Staten Island, N. Y.; M. J. Ball, Pittsburgh, Pa.; R. C. Faulkner, Toledo, Ohio; T. J. Twomey, Cincinnati, Ohio
Asst. Supts., G. I. Roberts and B. H. Barnes, Port Arthur, Tex.; J. E. Biggins, Philadelphia, Pa.; J. H. Wackenhut, Pittsburgh, Pa.; A. A. Niehenke, Toledo, Ohio; John W. Schriever, Cincinnati, Ohio
Mgr. Construction Div., Herbert Henderson
Mgr. Refinery Technology, H. G. Smith
Pur. Agt., C. T. March
Traf. Mgr., C. B. Ellis
Refineries located at Port Arthur, Tex.; Fort Worth, Tex.; Sweetwater, Tex.; Philadelphia, Pa.; Staten Island, N. Y.; Pittsburgh, Pa.; Toledo, Ohio, and Cincinnati, Ohio

H

Hancock Oil Co. of California, 2828 Junipero St., Long Beach, Calif.
Pres., W. J. Reid
V. P., Geo. D. Williams
Sec., John W. Hancock
Treas., G. P. Deane
Gen. Mgr., W. J. Reid
Gen. Supt., Geo. D. Williams
Supt., W. T. Hancock
Tank Car S. M., C. B. Limbocker
Station S. M., C. B. Limbocker
Ch. Chem., LaVerne Smith
Pur. Agt., W. Westegard
Refinery located at Long Beach, Calif.

Hausman, Louis, Oil Co., North Laredo, Tex.
Sole Owner, Louis Hausman
Ch. Chem., Marion Beaver
Refinery located at North Laredo, Tex.

Hightower Oil & Refining Corp., Brownwood, Tex.
Pres., Jas. A. Watt
V. P., A. W. Watt
Sec., H. W. Greenwood
Treas., A. W. Watt
Gen. Mgr., Jas. A. Watt
Gen. Supt., C. Stuart
Asst. Supt., J. Hudson
Tank Car S. M., C. D. Anderson
Sta. S. M., J. S. Pirie
Refinery located at Brownwood, Tex.

Hill Refining Co., Ballinger, Tex.
Sole Owner, Roy L. Hill
Refinery located at Ballinger, Tex.

Hole Brothers Refinery, Cut Bank, Mont.
Owners, A. H. Hole and B. V. Hole, Jr.
Refinery located at Cut Bank, Mont.

Home Oil & Refining Co., Great Falls, Mont.
Pres., W. E. Rice
V. P., John S. Rice
Sec. and Treas., Fred Erickson
Gen. Mgr., H. O. Batzer
Gen. Supt., Joe Faulkner
Asst. Supt., Gray Rankin
Sales Mgr., H. O. Batzer
Ch. Chem., Boyd Morris
Pur. Agt., H. O. Batzer
Refinery located at Great Falls, Mont.

Houston Oil Co. of Texas, Petroleum Bldg., Houston, Tex.
Pres., Geo. A. Hill, Jr.
V. P. and Treas., L. S. Zimmerman, Baltimore, Md.
Sec., A. H. Kennerly
Gen. Mgr., R. R. Hobson
Gen. Supt., F. Y. Hutchinson
Supt., G. H. Hartung, Viola, Tex.
Tank Car and Sta. S. M., J. B. Benson
Ch. Egr., F. Y. Hutchinson
Ch. Chem., R. H. Cook
Pur. Agt., O. S. Cummings, Jr.
Traf. Mgr., P. W. Schumacher
Refineries located at Camden, Ark., and Viola, Tex.

Howard County Refining Co., Big Spring, Tex.
Pres., Robert T. Piner
Sec., Joseph Edwards
Gen. Mgr., Joseph Edwards
Supt., J. F. Muense
Tank Car and Station S. M., J. Henry Edwards
Pur. Agt., J. Henry Edwards
Traf. Mgr., R. R. Hodge
Refinery located at Big Spring, Tex.

Hub Refining Co., Reeds Switch, Tex.
Owner, R. H. Foss
Refinery located at Reeds Switch, Tex.

Huckins Refinery, Earlsboro, Okla.
Sole Owner, J. C. Huckins
Refinery located at Earlsboro, Okla.

Humble Oil & Refining Co., Humble Bldg., Houston, Tex. (Subsidiary of Standard Oil Co. of New Jersey)
Pres., R. L. Blaffer
V. P.s, H. C. Weiss, Wallace E. Pratt, John R. Suman, Judge E. E. Townes, James Anderson
Sec., F. O. Freese
Treas., R. L. Blaffer
Gen. Counsel, Judge E. E. Townes
Gen. Mgr. of Ref., J. L. Finley
Ref. Mgr., R. E. Powell, Baytown
Supts., F. N. Read, Ingleside; G. L. Farned, Baytown; C. M. Bell, San Antonio; C. M. Dennison, Neches.
Asst. Supts., C. E. Carlson, M. L. Snyder, J. Harrop, W. P. Willis, Baytown; G. P. Curtin, Ingleside
Tank Car S. M., B. H. Brown
Station S. M., S. A. Giraud
Ch. Egr. Ref., Dr. E. F. Voss
Ch. Egr. Prod., W. W. Scott
Ch. Chem., Dr. H. D. Wilde, Jr.
Pur. Agt., J. A. Rowe
Traf. Mgr., J. R. Davis
Refineries located at Baytown, Ingleside, San Antonio and Neches

Hunt, Eugene, Refinery, 222 Second Ave, S., Lewistown, Mont.
Owner, Eugene Hunt
Supt., N. J. Korwald
Refinery located at Winnett, Mont.

Hurricane Petroleum Corp., 325 First National Bank Bldg., Shreveport, La.
Pres., Theodore Hoffacker, New York, N. Y.
V. P.'s, M. J. Grogan, B. P. Crittenden
Sec., H. T. McGown, Fort Worth, Tex.
Treas., T. H. Grobe
Gen. Mgr., B. P. Crittenden
Gen. Supt., J. A. O'Neill, Overton, Tex.
Sales Agts., Grogan Oil Co.
Ch. Chem., Mr. Scharnagel
Refineries located at Overton, Tex., and Haughton, La.

I

Ideal Refining Co., Gladewater, Tex.
Owners, J. L. Quinn and A. L. Weiss
Refinery located at Gladewater, Tex.

Illinois Oil Co., Rock Island, Ill.
Pres., Frank P. Welch
V. P., J. W. Armstrong
Sec. and Treas., F. R. Edwards
Gen. Mgr., Frank P. Welch
Gen. Supt., P. J. Glover, Cushing, Okla.
Asst. Supt., W. W. Kelly, Cushing
Tank Car and Station S. M., F. R. Edwards
Pur. Agt., F. R. Edwards
Traf. Mgr., P. J. Glover
Refinery located at Cushing, Okla.

Illinois Refining Co., Kilgore, Tex.
Owner, Roger Lacey
Refinery located at Kilgore, Tex.

Independent Refining Co., Fratt Bldg., Billings, Mont.
Pres., W. E. Rice, Great Falls, Mont.
V. P. and Gen. Mgr., D. E. Hageman
Sec., H. J. Coleman
Treas., D. E. Hageman
Supt., W. D. Manz
Sales Mgr., D. E. Hageman
Ch. Chem., J. M. Williams
Pur. Agt. and Traf. Mgr., P. A. Thomson
Refinery located at Laurel, Mont.

Indian Refining Co., 1 Havoline St., Lawrenceville, Ill. (Subsidiary of the Texas Corp.)
Pres., W. S. S. Rodgers
V. P.'s, P. C. Scullin, F. T. Manley, S. B. Wright, H. W. Dodge
Sec., E. M. Crone
Treas., C. E. Woodbridge
Gen. Mgr., P. C. Scullin
Supt., G. R. Bryant
Asst. Supt., W. B. Logan
Tank Car and Station S. M., T. C. Twyman, 5 East Market St., Circle Tower Bldg., Indianapolis, Ind.
Pur. Agt., A. F. Colling, 135 East Forty-second St., New York City
Refinery located at Lawrence, Ill.

Inland Refineries, Inc., 876 Penobscot Bldg., Detroit, Mich.
Pres., C. L. Skidmore
V. P., Paul Martin
Sec., B. F. Hall
Treas., Paul Martin
Gen. Supt., E. G. Guy
Refinery located at Drayton Plains, Mich.

J

Jackson Refining Co., Gladewater, Tex.
Owners, J. E. Connor, F. D. Jackson and C. D. Archer

Jenson Oil Refining Co., 304 Atlas Block, Salt Lake City, Utah
Pres., J. B. Jenson
V. P., Carl Selander
Sec. and Treas., Irma M. Jenson
Gen. Mgr., J. B. Jenson
Gen. Supt., Wm. G. Stenberg
Tank Car and Stations Mgr., R. N. Bostwick
Ch. Egr., Ira Packard
Refinery located at Ogden, Utah

Johnson, A. L., Refinery, Wayne, Ohio
Sole Owner, A. L. Johnson
Refinery located at Wayne, Ohio

Johnson Oil Refining Co., 176 West Adams St., Chicago, Ill.
Pres., I. H. Johnson
V. P. in Chg. Ref., L. Ralph Johnson
Ch. Board, J. J. Johnson
Sec., G. C. Lilly
Treas., J. O. Horton
Gen. Mgr., I. H. Johnson
Supt., W. J. Leenhouts, Cleveland, Okla.
Tank Car S. M., H. G. Plane
Bulk S. M., James J. Johnson
Ch. Chem., Frank P. Frey
Pur. Agt., V. C. Goward, Cleveland, Okla.
Traf. Mgr., G. A. Mindeman, Cleveland, Okla.
Refinery located at Cleveland, Okla.

Johnson Refining Co., Kilgore, Tex.
Owner, H. I. Johnson
Refinery located at Kilgore, Tex.

Joplin Refining Co., Box 866, Joplin, Mo.
Pres., A. E. Basinger
V. P., W. F. Maher
Gen. Supt., C. S. Banks
Tank Car and Station S. M., George J. Young
Refinery located at Joplin, Mo.

K

Kanotex Refining Co., A. C. Office Bldg., Arkansas City, Kans.
Pres. and Gen. Mgr., C. M. Boggs
V. P., W. L. Lesh
Sec., Mrs. E. K. Childers
Treas., R. R. Cox
Supt., F. A. Deering
Asst. Supt., Charles Wakefield
Ch. Egr., D. O. Givens
Ch. Chem., Guy S. Kirk
Pur. Agt., L. E. Watts
Traf. Mgr., C. E. Varner
Refinery located at Arkansas City, Kans.

Kendall Refining Co., Bradford, Pa.
Pres., Otto Koch
V. P.'s, H. H. Greene, Joseph H. Bovaird
Sec., J. Bertram Fisher
Treas., Otto Koch
Gen. Mgr., Otto Koch
Ref. Mgr., E. E. Bown
Process Supt., Francis J. Healy
Lub. S. M., T. O. Grisell
Sales Mgr., bulk, J. B. Fisher
Plant Egr., S. M. Wolbert
Ch. Chem., Frank J. Philippbar
Pur. Agt., J. B. Fisher
Traf. Mgr., James S. White
Refinery located at Bradford, Pa.

Kent Refining Co., Michigan Road, Grand Rapids, Mich.
Pres., J. J. Kerins
V. P., H. O. Butler
Sec., L. A. Geistert
Treas., J. J. Kerins
Gen. Mgr., H. O. Butler
Gen. Supt., J. J. Kerins
Asst. Supt., Willis Ireland
Sales Mgr. and Pur. Agt., H. O. Butler
Refinery located at Grand Rapids, Mich.

Keystone Oil Refining Co., 12800 Northampton Ave., Detroit, Mich.
Pres., Wm. Fisher
Sec., Leon Komisaruk
Treas., Wm. Fisher
Supt., Leon Komisaruk
Asst. Supt., Wm. H. Osborne
Tank Car S. M., Maurice Schiller
Ch. Egr., Wm. H. Osborne
Ch. Chem., Amos Comay
Pur. Agt., Wm. Fisher
Traf. Mgr., Irving Schiff
Refinery located at Detroit, Mich.

Keystone Refining Co., Gladewater, Tex.
Owner, S. B. Pope
Refinery located at Gladewater, Tex.

Kilgore Topping & Refining Co., Kilgore, Tex.
Owner, J. L. Tolbert
Refinery located at Kilgore, Tex.

Kilgore Refining Co., Kilgore, Tex.
Pres., J. D. Wrather
Treas., John Wrather
Sec., G. C. Walters

Kiltex Refining Co., Kilgore, Tex.
Owner, O. C. Thornton
Refinery located at Kilgore, Tex.

Knox Refining Co., Tenth Floor, Broadway Tower, Enid, Okla.
Sole Owner, Chas. E. Knox
Sales Mgr., Roy E. Raemer
Refinery located at Covington, Okla.

Kolingo Refining Co., Coalinga, Calif.
Refinery located at Coalinga, Calif.

L

Lakeland Refinery, Inc., 604 Olds Tower, Lansing, Mich.
Pres., J. E. Richardson
V. P., C. E. Bliss
Sec. and Treas., S. H. Ensign
Construction of 1,500-bbl. refinery at Trowbridge, Mich., planned.

Lake Refining Co., Gladewater, Tex.
Management, John Kraker.
Refinery located at Gladewater, Tex.

Lake View Oil & Refining Co., 1007 Edwards & Wildey Bldg., Los Angeles, Calif. (Receivership)
Receiver, Paul J. Hisey
V. P., A. J. Rehwold
Sec., Paul J. Hisey
Treas., C. F. Powers
Refinery located at Maricopa, Calif.

La Pren Refining Co., Kilgore, Tex.
Mgr., A. S. Robertson
Refinery located at Kilgore, Tex.

LaSalle Petroleum Co., 612 Wright Bldg., Tulsa, Okla.
Receivers, W. J. Schnur, Tulsa, Okla.; Phil D. Williams, Burkburnett, Tex.
Supt., Phil D. Williams, Burkburnett, Tex.
Sales Mgr., Phil D. Williams
Pur. Agt., Phil D. Williams
Traf. Mgr., J. E. Tanner
Refinery located at Burkburnett, Tex.

Lion Oil Refining Co., Exchange Bldg., El Dorado, Ark.
Pres., T. H. Barton
V. P.'s, T. M. Martin, M. E. Wilson, J. J. Allinson
Sec., Jeff Davis
Treas., R. E. Meinert
Gen. Mgr., T. H. Barton
Ref. Mgr., J. J. Allinson
Supt., J. B. Rogerson
Tank Car S. M., T. M. Martin
Asst. Tank Car S. M., P. G. Anderson
Station S. M., A. F. Reed
Asst. Station S. M., F. M. Rider
Ch. Chem., W. M. Carney, Jr.
Ch. Egr., J. B. Rogerson
Pur. Agt., R. E. Meinert
Traf. Mgr., P. G. Anderson
Refinery located at El Dorado, Ark.

Lone Star Refining Co., Gladewater, Tex.
Owner, V. C. Jackson
Refinery located at Gladewater, Tex.

Los Angeles Refining Co., 4037 Bandini Blvd., Los Angeles, Calif.
Pres., D. S. Fletcher
V. P. and Gen. Mgr., Glenn Dies
Sales Mgr., Samuel Goldman
Supt., Leonard Whitlock
Refinery located at Bandini, Calif.

Louisiana Oil Refining Corp., Ardis Bldg., Shreveport, La. (Subsidiary of Cities Service Co.)
Pres., H. O. Caster
V. P.'s, D. W. Harris, T. I. Carter, H. D. Frueauff and J. R. Munce
Sec., T. J. Heard
Treas., B. R. Muirhead
Gen. Mgr., D. W. Harris
Gen. Mgr. Ref., R. B. Pierce
Supt., H. R. Smith, Bossier plant
Asst. Supt., G. W. Wilbur, Bossier plant
Tank Car S. M., E. F. Brakefield
Gen. Station S. M., J. A. Welch
Ch. Egr., H. T. Goss
Ch. Chem., A. W. Trusty
Pur. Agt., J. Lucas
Traf. Mgr., E. M. Hinkle
Refineries located at Shreveport, La., and Bossier City, La. (Shreveport plant shut down)

Louisville Refining Co., Inc., 52 U. S. Trust Bldg., Louisville, Ky.
Pres., Eli H. Brown, Jr.
V. P., J. Fred Miles
Sec. and Treas., H. R. Smith
Gen. Mgr., J. Fred Miles
Asst. Supt., J. J. Loudermill
Tank Car S. M., H. R. Smith
Ch. Egr., E. S. Handley
Pur. Agt., W. A. Waples
Traf. Mgr., H. R. Smith
Refinery located at Louisville, Ky.

Lusk Oil & Refining Co., Lusk, Wyo.
Pres., J. W. Siegfried
V. P., W. Deedjen
Sec. and Treas., Don R. Saylor
Refinery located at Lusk, Wyo.

Mc

McCallen, M. M., Refining & Producing Co., Seventeenth and Garfield Sts., Huntington Beach, Calif.
Owner, M. M. McCallen
Auditor, J. T. Africa
Gen. Supt., P. L. Davis
Ch. Chem. and Pur. Agt., Roy Seabridge
Refinery located at Huntington Beach, Calif.

McClanahan Refineries, Inc., Mount Pleasant, Mich.
Pres., W. L. McClanahan
V. P., Eshern Hanson
Sec., Grant L. Cook
Treas., Arnold H. Goss
Gen. Mgr., D. E. Foster
Gen. Supt., M. C. Sumpter
Traf. Mgr., George E. Lowe
Refinery located at St. Louis, Mich.

McGarr Petroleum Corp., Kline, Colo.
Pres., G. M. McGarr
V.P., A. L. Kroeger
Sec., Ruth Z. Brazil
Treas., C. R. Brice
Refinery located at Kline, Colo.

McKain Refining Co., Gladewater, Tex.
Owner, Wm. H. McKain
Refinery located at Gladewater, Tex.

McMurray Refining Co., Arp, Tex.
Owners, Marvin McMurray and R. J. McMurray.
Refinery located at Arp, Tex.

McNutt Oil & Refining Co., Inc., P.O. Box 1161, El Paso, Tex.
Pres., C. M. McNutt
V. P., C. E. McNutt
Sec. and Treas., C. Blaine McNutt
Gen. Mgr., C. M. McNutt
Gen. Supt., C. E. McNutt
Asst. Supt., George A. Baker
Tank Car S. M., C. M. McNutt
Station S. M., C. M. McNutt
Ch. Chem. and Pur. Agt., C. E. McNutt
Traf. Mgr., Herbert L. McNutt, Sr.
Refinery located at Brickland, N. Mex.

McOwen, Howard A., 2240 South St., North Long Beach, Calif.
Refinery located at Long Beach, Calif.

M

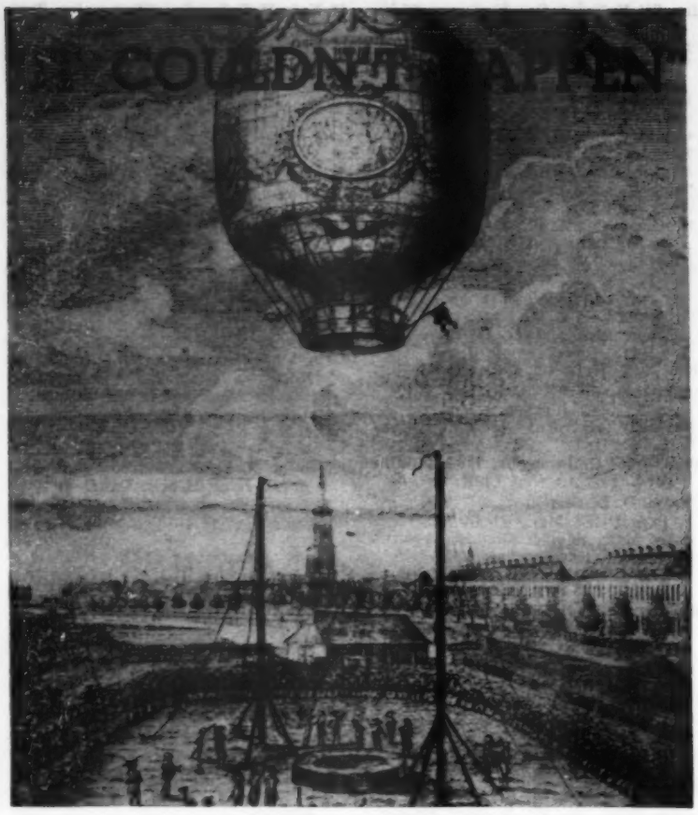
Macmillan Petroleum Corp., 530 West Sixth St., Los Angeles, Calif.
Pres., R. S. Macmillan
V. P.'s, H. E. Boner, H. R. Macmillan
Sec. and Treas., Dewitt Knox
Gen. Supt., H. E. Boner
Supts., De Ralph Frizell, Long Beach, and L. L. Rebber, El Dorado, Ark.
Tank Car S. M., Dewitt Knox, Los Angeles; S. M. Batterson, El Dorado, Ark.
Station S. M., W. G. Ebersole, Los Angeles.
Ch. Egr., C. C. Benz
Ch. Chem., S. E. Campbell
Refineries located at Long Beach, Calif., and El Dorado, Ark.

Magnolia Petroleum Co., Magnolia Bldg., Dallas, Tex.
Pres., D. A. Little
V. P.'s, W. H. Francis, E. E. Plumly, M. J. McLaughlin, J. C. Stephens, F. M. Lege, Jr., C. L. Gladden, T. J. Fitch, L. S. Sinclair.
Sec., Guy L. Tate.
Treas., W. L. Holmes
Gen. Mgr. Ref., E. E. Plumly
Supts., C. S. Dickens, Beaumont; W. W. White, Magpetco; John Ricker, Fort Worth; W. C. Ralston, Corsicana; J. T. Dickens, Luling.
Asst. Supts., G. E. Plumly, Beaumont; N. B. Marchbanks, Fort Worth; A. L. Hardy, Luling
Tank Car S. M., George Miller
Station S. M., F. M. Lege, Jr.
Ch. Egr., R. G. Sanders
Ch. Chem., W. W. Leach
Pur. Agt., J. F. David
Traf. Mgr., W. M. Maddox
Refineries located at Beaumont, Magpetco, Fort Worth, Corsicana and Luling.

Major Petroleum Products Co., 2500 E. Reno, Oklahoma City, Okla.
Pres., C. B. Warr
V. P., J. W. Lyons
Sec. and Treas., E. B. Treadwell
Gen. Mgr., W. U. Paul
Gen. Supt., W. O. Leek
Tank Car and Sta. S. M., E. A. Gilmore
Ch. Chem., Thomas Vaughn
Refinery located at Oklahoma City, Okla.

Malco Refineries, Inc., Artesia, N. Mex.
Pres., M. E. Barsh
V. P., L. R. Simon
Sec. and Treas., R. A. Shugart
Gen. Supt., L. R. Simon
Tank Car and Station S. M., R. L. Halley
Refinery located at Artesia, N. Mex.

Mancos Dome Refining Co., Farmington, N. Mex.
Trustee, A. C. Kittrell
Refinery located at Mancos Creek, Colo.



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Prevent Color Loss
Reduce Acid Treatments
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Sec., W. J. Willson
Treas., J. L. Cook
Gen. Supt., A. J. Slagter
Supts., J. R. Barrott, Bristow; W. R. Sonricker, Fort Worth
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Pur. Agt., W. R. Brown
Traf. Mgr., R. W. Smith
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V. P., R. V. McClain
Sec. and Treas., Floyd Casey
Gen. Supt., Carl Casey
Tank Car S. M., R. L. Seastrunk
Ch. Chem., Carl Casey
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Treas. and Gen. Supt., H. H. Biber
Refinery located at Venice, Calif.

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V. P.'s, J. C. Denton, R. W. McDowell, F. B. Koontz, E. M. Rouzer, Geo. Moody
Sec., E. M. Rouzer
Gen. Mgr., Jacob France
Treas., Charles Klein
Gen. Supt., F. B. Koontz
Supt., D. G. Morgan
Ch. Chem., H. T. Bennett
Pur. Agt., C. A. Prichard
Sales Mgr., R. W. McDowell
Traf. Mgr., H. W. Roe
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V.P., Wm. B. Davis
Sec. and Treas., Rufus W. Peckham
Consulting Egr., Geo. Benhoff
Ch. Egr., Geo. Benhoff
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V. P., Mahlon B. Johnson
Sec. and Treas., L. R. Hines
Gen. Mgr., Bruce Sullivan
Gen. Supt., V. C. Langford
Tank Car S. M., W. C. Williams
Ch. Egr., Howard L. Minister
Ch. Chem., C. Fred Russell
Pur. Agt., Cliff L. Messenger
Traf. Mgr., J. Fred Foley
Refinery located at Brighton Road, Denver, Colo.

Midway Oil & Refining Co., 304 South New Braunfels Avenue, San Antonio, Tex.
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Sec., H. H. Newton
Treas. and Pur. Agt., W. T. Hart
Gen. Mgr. and Sales Mgr., D. C. Moore
Gen. Supt., Dee Roberson
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V.P., T. E. McFall
Sec., F. S. Grimes
Treas., F. S. Grimes
Gen. Mgr., B. J. Skinner
Supt., J. Marshall
Asst. Supt., B. Thurston
Sales Mgr., F. S. Grimes
Pur. Agt., B. J. Skinner and F. S. Grimes
Refinery located at Alma, Mich.

Miller, A. D., Sons Co., 1801 Preble Ave., Pittsburgh, Pa.
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V. P., A. D. Miller, III
Sec., O. B. Opsion
Treas., A. D. Miller, III
Gen. Mgr., J. B. Miller
Gen. Supt., O. B. Opsion
Supt., Wm. Clowes
Asst. Supt., Geo. Clowes
Tank Car S. M., O. B. Opsion
Ch. Egr., Wm. Clowes
Ch. Chem., J. B. Miller
Pur. Agt., J. B. Miller
Traf. Mgr., O. B. Opsion
Refinery located at Pittsburgh, Pa.

Minntana Oil Co., 831 Second Ave., S., Minneapolis, Minn.
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Sec. and Treas., R. M. Heskett
Supt., Marvin Olson
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Mohawk Petroleum Co., 405 Montgomery St., San Francisco, Calif.
Pres., Alfred L. Marsten
V. P., Edwin V. McKenzie
Sec. and Treas., M. E. Roof
Supt., J. A. Robinson, Bakersfield
Refinery located at Bakersfield, Calif.

Monarch Refineries, Ltd., 820 Detwiler Bldg., Los Angeles, Calif.
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V. P., W. J. Williams
Sec. and Treas., C. W. Fourl
Gen. Supt., Frank McGee
Station S. M., Homer Ames
Refinery located at Playa Del Rey, Calif.

Monarch Refining Co., Oklahoma City, Okla.
Pres., C. B. Vandervoort
Sec. and Treas., W. E. Steelman
Tank Car S. M., W. E. Steelman
Refinery located at Oklahoma City, Okla.

Moutray Oil Co., 602 Pine St., Abilene, Tex.
Pres., E. W. Moutray
V. P., C. B. Snyder
Sec. and Treas., M. P. Moutray
Gen. Mgr., E. W. Moutray
Gen. Supt., W. W. Moutray
Asst. Supt., W. C. Vernon
Tank Car S. M., E. W. Moutray
Station S. M., Paul Kirk
Ch. Chem., W. C. Vernon
Refinery located at Hawley, Tex.

Muenster Refining Co., Muenster, Tex.
Owner and Supt., A. G. Hutton
Refinery located at Muenster, Tex.

N

Naph-Sol Refining Co., R.F.D. 3, Muskegon, Mich.
Pres., Walter E. Anderson
V. P., J. F. Helms
Sec. and Treas., A. W. Penny
Gen. Mgr., Walter E. Anderson
Gen. Supt., J. F. Helms
Asst. Supt., Russell Potts
Tank Car S. M., Allen F. Hickey
Ch. Chem., Walter C. Fisher
Pur. Agt., C. S. Walkowiak
Traf. Mgr., J. A. Sundquist
Refinery located at Muskegon, Mich.

National Refining Co., Hanna Bldg., Cleveland, Ohio
Pres., W. H. Lamprecht, II
V. P.'s, C. S. Smith, H. F. Heil
Sec., J. D. Sadler
Treas., H. F. Heil
Gen. Supt., W. H. Lamprecht, II
Refineries located at Colleyville, Kans.; Findlay and Marietta, Ohio

Northwestern Petroleum Co., Osage, Wyo.
Gen. Mgr., F. W. Palis
Refinery located at Osage, Wyo.

Norwalk Co., 634 South Spring St., Los Angeles, Calif.
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V. P., H. J. Barneson
Sec., W. E. Kropp, 256 Montgomery St., San Francisco
Gen. Mgr., L. L. Aubert

Asst. Gen. Mgr., H. M. Paulsen
Supt., Jack Brennan, Maricopa
Asst. Supt., L. F. Moore, Maricopa
Ch. Chem., H. F. Ball, Maricopa
Pur. Agt., John C. Penn
Refinery located at Maricopa, Calif.

Nueces Refining Co., 1107 Nixon Bldg., Corpus Christi, Tex.
Receiver, M. J. Eckhardt
Pres., Frank R. Williams, Smith Young Tower, San Antonio, Tex.
V. P., Pryor Tunstall, Smith Young Tower, San Antonio, Tex.
Sec. and Treas., Irma Smith, Smith Young Tower, San Antonio, Tex.
Mgr. for Receiver, E. O. Goodson
Gen. Supt., R. W. Canfield
Ch. Egr., R. W. Canfield
Ch. Chem., D. A. Price, Banquette, Tex.
Pur. Agt., E. A. Goodson
Refinery located at Banquette, Tex.

O

Ocean Refining Co., Kilgore, Tex.
Owners, Jess Weaver, Jack William and T. G. Shepard
Refinery located at Kilgore, Tex.

Ohio Oil Co., 539 South Main St., Findlay, Ohio
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V. P.'s, C. L. Fleming, W. W. Fleming, G. E. McCullough, John McFadden.
Sec., E. B. Redpath
Treas., F. A. Billstone
V. P. in Charge Ref. and Mark., C. L. Fleming.
Supt., R. E. Luton, Robinson, Ill.
Asst. Supt., H. E. Handy, Robinson, Ill.
Tank Car S. M., N. T. Stover, Robinson, Ill.
Station S. M., C. L. Fleming
Ch. Chem., T. W. Culmer, Robinson, Ill.
Pur. Agt., C. S. Sherk
Traf. Mgr., E. W. Evans
Refinery located at Robinson, Ill.

Ohio Valley Refining Co., 201 Barkwill St., St. Mary's, W. Va.
Pres., J. P. Flynn
V. P., H. J. Crawford
Sec. and Treas., W. R. Reitz
Supt., J. B. Northrop
Asst. Supt., T. A. Anderson
Tank Car S. M., A. M. Kiester
Ch. Chem., G. R. Dye
Traf. Mgr., H. M. Locke
Pur. Agt., J. B. Northrop
Refinery located at St. Mary's, W. Va.

Oil Creek Refining Co., P.O. Drawer 506, Titusville, Pa.
Pres. and Gen. Mgr., Frank J. McGraw
V. P. and Sec., Geo. L. Ehrhart
Treas., M. D. Woods
Tank Car S. M., Frank J. McGraw
Ch. Egr., Raymond Dardes
Ch. Chem., Geo. L. Acton
Traf. Mgr., M. D. Woods
Pur. Agt., G. L. Ehrhart
Refinery located at East Titusville, Pa.

Old Dutch Refining Co., Box 442, Muskegon, Mich.
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V. P., G. S. Turner, Jr.
Sec., Willard G. Turner, Jr.
Treas., F. H. Duggan
Gen. Mgr., John Borden
Gen. Supt., F. J. McCormick
Asst. Supt., C. H. Smith
Tank Car S. M., G. S. Turner, Jr.
Station S. M., G. S. Turner, Jr.
Ch. Egr., F. J. McCormick
Ch. Chem., J. G. Southern
Pur. Agt., N. Buining
Traf. Mgr., John Dalson
Refinery located at Muskegon, Mich.

Oney Oil & Refining Co., 1011 City National Bldg., Wichita Falls, Tex.
Pres., Frank Kell
V. P., J. A. Kell
Sec. and Treas., R. G. Cocanower
Gen. Mgr., R. G. Cocanower
Gen. Supt., P. E. Slater
Tank Car and Station S. M., R. G. Cocanower
Refinery located at North Olney, Tex.

Olympic Refining Co., 2425 California St., Long Beach, Calif.
Exec. V. P. and Gen. Mgr., Philip E. Johnson
Sec. and Treas., J. M. Fisher
Refinery located at Long Beach, Calif.

Omar Refining Co., Roberts Bldg., Tulsa, Okla.
Pres., F. S. Whitaker
V. P., J. H. Whitaker
Sec. and Treas., M. H. Collins
Gen. Supt., O. D. Gurley
Tank Car S. M., J. H. and F. S. Whitaker
Ch. Chem., Paul Williams
Pur. Agt., O. D. Gurley
Traf. Mgr., V. C. Gibson
Refinery located at Garber, Okla.

Oreana Refining Co., La Barge, Wyo.
Sole Owner, Harold Riley
Supt., S. Grinch
Refinery located at La Barge, Wyo.

Oriental Oil Co., 1911½ Pacific Ave., Dallas, Tex.
Pres., W. R. Smith
V. P. and Gen. Mgr., Frank M. Smith
Sec. and Treas., D. C. White
Gen. Mgr., Frank M. Smith
Gen. Supt., W. T. Evans
Tank Car S. M., B. H. Pitman
Station S. M., M. T. Smith
Ch. Egr., J. D. Scruggs
Ch. Chem., W. T. Evans
Pur. Agt., B. H. Pitman
Traf. Mgr., B. H. Pitman
Refinery located at West Dallas, Tex.

Osage Refining Co., Osage, Wyo.
Pres., E. C. Winters, 908 Midland, Kansas City, Mo.
Sec. and Treas., R. E. Cunningham, Kansas City, Mo.
Gen. Supt., C. Hunter
Refinery located at Osage, Wyo.

Ouachita Valley Refining Co., P.O. Box 610, El Dorado, Ark.
Pres., John E. Shatford
Sec., E. B. Wall
Treas., C. L. Crenshaw
Gen. Supt., John E. Shatford
Asst. Supt., H. J. Shatford
Tank Car S. M., C. L. Crenshaw
Ch. Egr., John E. Shatford
Pur. Agt., C. L. Crenshaw
Traf. Mgr., C. L. Crenshaw
Refinery located at El Dorado, Ark.

Outdoor Refining Co., Kilgore, Tex.
Owners, A. Batkins, J. H. Bishop and J. McAlister
Refinery located at Kilgore, Tex.

Overton Refining Co., Overton, Tex.
Pres., J. D. Wrather
Treas., John Wrather
Sec., G. C. Walters
Refinery located at Overton, Tex.

Ozozo Refining Co., Friars Switch, Tex.
Owner, J. I. Staley
Refinery located at Friars Switch, Tex.

P

Panama Refining Co., Kilgore, Tex.
Pres. and Treas., A. Fanding
Sec., R. H. Canterbury
Gen. Supt., L. B. Wilkinson
Sales Mgr., T. B. Hancock
Ch. Chem., J. P. Stepp
Pur. Agt., R. H. Canterbury
Refinery located at Kilgore, Tex.

Pan American Petroleum & Transport Co., 122 East Forty-second St., New York City (Subsidiary of Standard Oil Co. of Indiana)
Chm., E. G. Seubert
V. Chm., Dr. R. E. Wilson
V. P. and Asst. to V. Chm., E. G. McKeever
Pres., Louis Blaustein
V. P.'s, Jacob Blaustein, J. A. Carroll, Jr., J. S. Wood, C. F. Hatmaker.
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Asst. Supts., William Mellendick, Baltimore, Md.; H. J. Broderson, Texas City, Tex.
Traf. Mgr., J. S. Wood
Pur. Agt., J. A. Whitely
Refineries located at Baltimore, Md.; Savannah, Ga., and Texas City, Tex.

Pan American Southern Corp., Canal Bank Bldg., New Orleans, La.
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V. P.'s, A. E. Ralston, J. A. Carroll, Jr.
Sec., D. H. Baker
Treas., J. A. Carroll, Jr.
Asst. Sec. and Treas., A. N. Penn
Gen. Supt., D. J. Smith
Supt., F. W. Grey, Destrehan, La.
Pur. Agt., J. A. Whitely
Traf. Mgr., J. S. Wood
Refinery located at Destrehan, La.

Panhandle Refining Co., Wichita Falls, Tex.
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Sec., H. F. Bennett
Treas., M. A. Chambers
Gen. Mgr., Roy B. Jones
Gen. Supt., W. F. Sims
Asst. Supts., W. R. Ellis, Wichita Falls, Tex., and R. Jacobs, Kings Mill, Tex.
Tank Car and Station S. M., G. W. Reed
Ch. Egr., W. F. Sims
Ch. Chem., W. R. Ellis
Pur. Agt., W. H. Cook
Traf. Mgr., J. H. Davenport
Refineries located at Wichita Falls, Tex., Kings Mill, Tex. and Lueders, Tex.

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V. P., W. H. Lowe
Sec., R. Obea
Treas., R. H. Shainwald
Gen. Mgr., W. H. Lowe
Supt., O. H. Robertson, Emeryville, Calif.
Ch. Egr., J. T. Coleman
Ch. Chem., L. S. Read
Pur. Agt., A. H. Silverstone
Traf. Mgr., A. W. Brown
Refinery located at Emeryville, Calif.

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V. P., I. M. Grober
Sec. and Treas., Henry W. Harriman
Gen. Mgr., G. A. Grober
Gen. Supt., G. A. Grober
Ch. Egr. and Chem., Ed Millard
Refinery located at Artesia, N. Mex.

Pedro Refining Co., New Castle, Wyo.
Owner, B. V. Hole, Sr.
Refinery located at New Castle, Wyo.

Peninsula Oil Co., Port Clinton, Ohio
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V. P., G. J. Becker
Sec. and Treas., R. L. Seufert
Gen. Mgr. and Pur. Agt., C. W. Underwood
Supt., S. D. LeCrane
Asst. Supt., Herb Sass
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Owner, J. C. Calloway
Refinery located at Kilgore, Tex.

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V. P., G. E. Cowden
Sec., H. E. Lawrence
Treas., D. F. Cowden
Gen. Mgr., M. F. Cowden
Gen. Supt., S. P. Stannard
Tank Car and Station S. M., H. S. Hayden
Refinery located at Eldred, Pa.

Pennsylvania Refining Co., Butler, Pa.
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V. P.,A. B. Weingard
Sec. and Treas., Paul R. Beck
Gen. Mgr., W. W. Beck
Supts., G. W. Kirkwood, Karns City, Pa.; Adam Mosher, Titusville, Pa.
Tank Car S. M., M. H. Hindman
Ch. Chem., James Eisler
Traf. Mgr., W. S. Schoenfeld
Refineries located at Karns City and Titusville, Pa.

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V. P.'s, J. F. Vandeventer, W. S. Zehrung
Chm., C. L. Suhr
Sec., R. A. Browne
Treas., M. A. Brewster
Gen. Mgr., R. S. King
Gen. Supt., L. D. Fulton
Asst. Supts., J. M. Hinman, D. J. Harvey
Lub. Oil S. M., W. S. Zehrung
Tank Car S. M., R. A. Browne
Station S. M., W. R. Birkmayr
Ch. Egr., P. M. Robinson
Ch. Chem., Dr. G. O. Ebrey
Pur. Agt., A. W. Clinger
Traf. Mgr., D. E. Carrier
Refinery located at Oil City, Pa.

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V. P., Harold R. Pauley
Sec., James P. Fitzpatrick
Treas., Percy F. Cartzdafner
Gen. Supt., Geo. E. Miller
Asst. Supt., Norman Tyacke
Gasoline S. M., Wm. A. Burns
Fuel Oil S. M., W. J. Mintline
Ch. Chem., Ralph Tarshis
Pur. Agt., Harold R. Pauley
Traf. Mgr., A. S. Hovey
Refinery located at Los Angeles, Calif.

Petroleum Products Co., Chanute, Kans.
Pres., Frank Young
V. P., P. F. Mote
Sec. and Treas., H. B. Williams
Gen. Mgr., H. B. Williams
Supt., B. C. Kiplinger
Sales Mgr. and Pur. Agt., H. B. Williams
Refinery located at Chanute, Kans.

Pettus Oil & Refining Co., Pettus, Tex.
Pres., Morris Roberts
V. P., W. D. Walton
Sec. and Treas., Geo. A. Ray, Jr.
Gen. Mgr., Morris Roberts
Gen. Supt., A. W. Lewis
Supts., John Pollard, Pettus, Tex.; Roy W. Machen, Mathis, Tex.
Tank Car S. M., A. W. Lewis
Station S. M., Fred R. Owens
Ch. Egr. and Chem., Roy W. Machen
Pur. Agt., Morris Roberts
Traf. Mgr., S. R. Hunt
Gen. Auditor, E. G. Boyle
Refineries located at Pettus, Tex., and Mathis, Tex.

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Pres., Frank Phillips
V. P.'s, John H. Kane, Wm. N. Davis, C. P. Dimit, H. E. Koopman, J. M. Sands, R. H. Lynn, G. G. Oberfell, H. A. Trower, F. E. Rice, C. R. Musgrave, M. P. Youker
Sec., B. F. Stradley
Treas., K. S. Adams
Mgr. of Refineries, M. P. Youker
Asst. Mgr. of Refineries, W. G. Hiatt
Supts., Hugh Miller, Borger, Tex.; J. W. Mitchell, Kansas City, Kans.; R. D. Evans, Okmulgee, Okla.
Marketing Dept., H. A. Trower
Gen. Sales Mgr., A. M. Hughes
Tank Car S. M., H. A. Gardner
Pur. Agt., H. E. Koopman
Traf. Dept., C. R. Musgrave in chg.
Traf. Mgr., E. C. Kitching
Refineries located at Borger, Tex.; Kansas City, Kans., and Okmulgee, Okla.

Phoenix Refining Co., Inc., P.O. Box 5055, Dallas, Tex.
Pres., Raymond R. Russell
V. P., Dr. Daniel Russell
Sec., Mrs. R. R. Russell
Gen. Mgr., E. E. Wallace
Supt., J. F. Muense, Dallas; J. H. Hall, Pettus.
Refineries located at Dallas and Pettus, Tex.

Pilgrim, Inc., Ardmore, Okla.
Pres., Walter Neustadt
V. P., Max Westheimer
Sec. and Treas., D. W. Neustadt
Supt., M. Blakley
Refinery located at Kingston, Okla.

Pioneer Oil & Refining Co., 604 Carolina St., San Antonio, Tex.
Pres. and Gen. Mgr., A. B. Slimp
V. P., C. A. Slimp
Sec. and Treas., M. L. Roark
Supt., H. B. Slimp
Asst. Supt., J. P. McFarland
Tank Car S. M., A. W. Nunn
Bulk S. M., F. A. Slimp
Ch. Egr., H. B. Slimp
Ch. Chem., A. I. Robertson
Traf. Mgr., A. W. Nunn
Refinery located at Somerset, Tex.

Plainview Refining Co., Plainview, Tex.
Pres., J. C. Hooper
V. P., J. N. Jordan
Sec. and Treas., O. D. Byrd
Gen. Mgr., E. M. Corah
Supt., L. A. Martin
Asst. Supt., J. C. Yeager
Sales Mgr., E. M. Corah
Pur. Agt., O. D. Byrd
Traf. Mgr., E. M. Corah
Refinery located at Plainview, Tex.

Pope Refining Co., Gladewater, Tex.
Owner, S. B. Pope
Refinery located at Gladewater, Tex.

Posolube Refining Co., 4011 Bandini Blvd., Los Angeles, Calif.
Pres., G. A. Lathrope
V. P., O. Lockhart
Sec., W. P. Davenport
Treas., H. Breuster
Gen. Mgr., G. A. Lathrope
Supt., W. P. Davenport
Sales Mgr., W. P. Davenport
Ch. Chem., J. Lauretzien
Pur. Agt., W. P. Davenport
Refinery located at Los Angeles, Calif.

Premier Oil Refining Co., Box 1328, Longview, Tex.
Pres., Sylvester Dayson
V. P.'s, S. W. Ross and R. A. Stacy
Sec. and Treas., Richard W. Blalock
Tank Car S. M., Sylvester Dayson
Ch. Egr., L. G. Dufilho
Ch. Chem., W. S. Cazort, Jr.
Pur. Agt., P. H. Hargis
Refinery located at Longview, Tex.

Producers Oil & Refining Co., Kilgore, Tex.
Owner, A. F. Anding
Refinery located at Kilgore, Tex.

Pure Oil Co., 35 East Wacker Drive, Chicago, Ill.
Pres., H. M. Dawes
V. P.'s, C. B. Watson, R. W. McIlvaine, N. H. Weber, F. S. Heath, L. S. Wescoat, Rawleigh Warner.
Sec., L. S. Wescoat
Treas., Rawleigh Warner
Gen. Supt., R. C. Osterstrom
Supts., K. B. May, Midland, Mich.; E. E. McPherson, Heath, Ohio; J. R. Palmer, Cabin Creek, W. Va.; G. T. Yost, Muskogee, Okla.; R. L. Vernor, Smith's Bluff, Tex.; E. A. McCadden, Marcus Hook, Pa.; O. B. Wendein, Toledo, Ohio.
Asst. Supts., J. C. Megraw, Cabin Creek, W. Va.; J. S. Allen, Smith's Bluff, Tex.; J. J. Grace, Marcus Hook, Pa.; H. L. Smith, Toledo, Ohio; J. B. Price, Muskogee, Okla.; I. L. Hostetler, Heath, Ohio.
Tank Car S. M., R. H. McElroy, Jr.
Station S. M., G. C. Morris
Ch. Egr., D. E. Sullivan
Ch. Chem., C. R. Wagner
Pur. Agt., G. L. Parsons
Traf. Mgr., H. Hauseman
Refineries located at Midland, Mich.; Heath, Ohio; Cabin Creek, W. Va.; Muskogee, Okla.; Smith's Bluff, Tex.; Marcus Hook, Pa., and Toledo, Ohio

Q

Quaker State Oil Refining Corp., Chambers Bldg., Oil City, Pa.
Pres., H. J. Crawford
V. P.'s, S. Messer, James D. Berry
Sec. and Asst. Treas., W. R. Reitz
Treas. and Asst. Sec., Charles D. Berry
Gen. Supt., G. B. Hunter
Supts., E. E. Ebner, Emlenton, Pa.; W. H. Rockman, Farmers Valley, Pa.
Tank Car S. M., A. R. Newton, Jr., Emlenton; K. B. Ogilvie, Farmers Valley
Refineries located at Emlenton, Pa., and Farmers Valley, Pa.

R

Rado Refining & Producing Co., McAllen, Tex.
Pres., Chas. J. Holland
V. P., Walter K. Campbell
Sec., John Lobdell
Treas., Ralph E. Fair
Gen. Supt., Chas. J. Holland
Sales Mgr., Walter K. Campbell
Refinery located at McAllen, Tex.

Raven Oil & Refining Co., Rangely, Colo.
Pres., J. W. Leonard, Washington, Pa.
V. P., F. G. Cary, Lodi, Calif.
Sec. and Treas., R. A. Bryson
Gen. Mgr., R. A. Bryson
Gen. Supt., M. M. Cook
Pur. Agt., R. A. Bryson
Refinery located at Rangely, Colo., (Products marketed by Continental Oil Co.)

Red River Refining Co., Inc., 4323 S. Western Blvd., Chicago, Ill.
Pres., P. B. Flynn
V. P., J. P. Goodrich
Sec. and Treas., R. S. Watt
Supt., C. A. Harris, Burnham, Ill.
Asst. Supt., Albert Conrad
Ch. Eng., R. U. Becknell
Ch. Chem., J. E. Schulze
Pur. Agt., C. A. Harris
Traf. Mgr., John Hayden
Refinery located at Burnham, Ill.

Republic Oil Refining Co., Second National Bank Bldg., Houston, Tex.
Pres., O. D. Robinson
V. P.'s, J. O. Corner, D. W. Hovey, W. E. Huston
Sec. and Treas., W. H. Moreland
Gen. Mgr., O. D. Robinson
Gen. Supt., D. W. Hovey
Supt., C. E. Robertson, Texas City, Tex.
Asst. Supt., C. C. Evans, Texas City, Tex.
Tank Car and Station S. M., J. O. Corner
Ch. Egr., Louis Keller
Ch. Chem., Fred Sanberg
Pur. Agt., E. L. Sauer
Traf. Mgr., O. R. Eytel
Refinery located at Texas City, Tex.

Rex Oil Refinery, Inc., Rapid City, S. Dak.
Pres., Elmer Ratcliff
V. P., E. P. English
Treas. and Gen. Mgr., G. M. Lewis
Ch. Egr., Elmer Ratcliff
Ch. Chem., E. P. English
Refinery located at Rapid City, S. Dak.

Rice Ranch Oil Co., 262 South Los Angeles St., Los Angeles, Calif.
Pres., W. Litchenberger
Sec., H. G. Phillips
Refinery located at Santa Maria, Calif.

Richfield Oil Co. of California, Richfield Bldg., Los Angeles, Calif.
Receiver, William C. McDuffie
Gen. Supt., A. M. Kelley
Supt., R. A. Panero, Wilmington, Los Angeles County, Calif.
Gen. Sales Mgr., R. W. Walsh
Ch. Egr., David E. Day
Ch. Chem., C. K. Hewes
Pur. Agt., B. J. Mahaffy
Traf. Mgr., W. O. Narry
Refineries—Watson refinery, Hynes refinery, Los Angeles, Bakersfield (the two latter shut down)

Rio Grande Oil Co., 417 South Hill St., Los Angeles, Calif. (Controlled by Consolidated Oil Corp.)
Pres., Chas. S. Jones
V. P.'s, H. E. Britzman, Frank A. Morgan
Sec. and Treas., M. R. Gross
Gen. Mgr., C. S. Jones
Gen. Supt., J. J. Downey
Supt., William Murray, Vinvale, Calif.
Dir. of Sales, H. E. Britzman
Gen. Sales Mgr., A. H. Harris
Ch. Chem., M. Bach
Pur. Agt., H. H. Kelly
Traf. Mgr., A. L. Sarrels
Refinery located at Vinvale, Calif.

River Dome Refinery, 724 First St., East, Round Up, Mont.
Pres., L. R. Carroll
V. P., W. T. Carroll
Sec., H. J. Carroll
Treas., L. R. Carroll
Supt. Ref., L. R. Carroll
Refinery located at Round Up, Mont.

Rock Island Refining Co., Oklahoma Bank Bldg., Duncan, Okla.
Pres., L. B. Simmons
V. P.'s, L. E. Kincannon, E. J. Glover, O. W. Simmons
Sec. and Treas., W. Witt
Gen. Mgr., L. B. Simmons
Supt., A. L. Rayburn, Beckett, Okla.
Asst. Supt., A. R. Love, Beckett
Tank Car S. M., E. J. Glover
Station S. M., E. J. Glover
Ch. Chem., Hugh A. Neal
Pur. Agt. and Traf. Mgr., R. H. Roper
Refinery located at Beckett, Okla.

Rodessa Oil & Refining Co., Box 38, Shreveport, La.
Pres., M. J. Grogan
V. P. and Gen. Mgr., B. P. Crittenden
V. P. and S. M., W. F. Kostelka
Sec. and Treas., J. E. Marshall
Gen. Supt., H. D. McLean
Ch. Egr., F. L. Bray
Pur. Agt., O. D. Shaver
Traf. Mgr., C. C. Correll
Refinery located at Cedar Grove, La.

Roosevelt Oil Co., P. O. Box 168, Mount Pleasant, Mich.
Pres., C. L. Maguire
V. P., T. F. Caldwell
Sec. and Treas., S. M. Fasquelle
Gen. Mgr., C. L. Maguire
Supt., E. R. Hively
Asst. Supt., D. Y. Hewitt
Station S. M., T. F. Caldwell and H. E. Bangert
Tank Car S. M., T. F. Caldwell and H. E. Bangert
Ch. Chem., Wm. B. Howard, Jr.
Pur. Agt., E. R. Hively and S. M. Fasquelle
Traf. Mgr., B. E. Kothe
Refinery located at Mount Pleasant, Mich.

Root Petroleum Co., 1000 Commercial Bank Bldg., Shreveport, La.
Pres., D. P. Hamilton
V. P.'s, Horace Canon and S. G. Lyon
Sec., T. E. Beaird
Treas., L. C. Hallonquist
Gen. Mgr., D. P. Hamilton
Supt., Ed Kimes, El Dorado, Ark.
Asst. Supt., John Brown, El Dorado
Tank Car S. M., D. A. Brown
Ch. Egr., R. T. Colquette
Ch. Chem., T. L. McNamara
Pur. Agt., T. E. Beaird
Traf. Mgr., R. L. Aycock
Refinery located at El Dorado, Ark.

Rusk Oil & Refining Co., Box 270, Tyler, Tex.
Pres., H. H. Coffield
V. P., George P. Mann
Sec. and Treas., J. H. Edwards
Gen. Supt., George P. Mann
Sales Mgr., J. H. Edwards
Refinery located at Overton, Tex.

Russell Oil Co., 642 Utah Ave., Butte, Mont.
Pres., Mrs. Joseph Russell
Sec., Ludwig Renland
Treas., Peter Aarrestad
Gen. Mgr., Fred Woodhull
Gen. Supt., Wilfred Trethewey
Supt., Wilfred Trethewey, Billings; John Hoen, Butte
Asst. Supts., Pete Aarrestad, Butte; John Oakland, Billings
Tank Car S. M., Ray Evans
Station S. M., Jess Stewart
Ch. Egr., Ebner Kolstead
Ch. Chem., Arnold Bjorneby
Pur. Agt., Mrs. Joseph Russell
Refineries located at Butte and Billings, Mont.

Russell Refining Co., Russell, Kans.
Pres., Chas. Lacheskey
V. P., R. C. Russell
Sec. and Treas., Robt. Tohlberg
Gen. Supt., W. F. Mitchell
Tank Car S. M., H. N. Whitaker
Traf. Mgr., H. N. Whitaker
Refinery located at Russell, Kans.

S

Sabine Refining Co., Gladewater, Tex.
Owner, John Kraker
Refinery located at Gladewater, Tex.

Samuell, J. Howard, Refinery, P.O. Box 304, Coleman, Tex.
Pres., Howard Samuell
V. P.'s, C. L. Mattocks, Claude Morris
Sec. and Treas., R. A. Hodges
Gen. Supt., Jack Gracey
Tank Car S. M., Howard Samuell
Pur. Agt., R. A. Hodges
Refinery located at Coleman, Tex.

San Fernando Refining Co., Box I, San Fernando, Calif.
Sole Owner, J. O. Moffett
Gen. Mgr., J. O. Moffett
Supt., Wm. D. Parks
Asst. Supt., L. D. Haworth
Station S. M., W. E. Moffett
Ch. Chem., L. D. Haworth
Pur. Agt., E. A. Ericson
Refinery located at Newhall, Calif.

Savon Oil & Refining Co., Bakersfield, Calif.
Supt. and Mgr., Louis O. Macloon
Refinery located at Fruitvale field, Bakersfield, Calif.

Seaside Oil Co., Summerland, Calif.
Pres., J. F. Bushnell
Sec. and Treas., M. W. O'Brien
Supts., D. C. Peet, Ventura, Calif.; D. Searles, Summerland
Tank Car S. M., J. F. Bushnell
Station S. M., Winslow Bushnell
Pur. Agt., E. H. Beresford
Refineries located at Ventura and Summerland, Calif.

Shamrock Oil & Gas Co., 602 Amarillo, Bldg., Amarillo, Tex.
Pres., John J. Sheerin
V. P.'s, H. C. Fownes II, R. T. Wilson
Sec., J. B. Orr
Treas., H. C. Fownes II
Gen. Mgr., John J. Sheerin
Gen. Supt., E. C. Will
Supts., H. B. Wade, Meldavis (Lefors), Tex.; R. S. Mims, Sunray, Tex.
Tank Car and Station S. M., N. E. Schneider
Refineries located at Meldavis (Lefors), Tex., and Sunray, Tex.

Shell Oil Co., 100 Bush St., San Francisco, Calif. (Subsidiary of Shell Union Oil Co.)
Pres., S. Belither
V. P.'s, E. F. Davis, J. U. Stair, D. Heggie, A. E. Lacomble, W. F. Durkee, Jr.
Sec., A. R. Bradley
Treas., D. Heggie
V. P. in Chg. Ref., A. E. Lacomble
Supts., D. M. Day, Martinez and Coalinga, Calif.; C. O. F. Jenkin, Wilmington and Dominguez, Calif.
Gen. Sales Mgr., L. T. Kittinger
Ch. Egr., N. W. Thompson
Pur. Agt., J. C. Storey
Traf. Mgr., C. E. Donaldson
Refineries located at Martinez, Coalinga, Wilmington and Dominguez, Calif.

Shell Petroleum Corp., Shell Bldg., St. Louis, Mo. (Subsidiary of Shell Union Oil Corp.)
Pres., Alexander Fraser
V. P.'s, Richard Airey, H. H. Anderson, G. S. Rollin, T. E. Swigart, J. W. Watson, R. P. Bascom, A. J. Galloway, H. Bloemgarten
V. P. Exploration, W. van Holst Pellekaan
V. P. Sales, L. van Eeghen
V. P. Mfg., A. E. Lacomble
Sec., P. R. Chenoweth
Treas., J. W. Watson
Mgr. of Ref., R. B. High
Supts., Dr. H. S. Waser, Wood River, Ill.; F. S. Clulow, East Chicago, Ind.; W. Mullemeister, Houston, Tex.; R. C. Roberts, Arkansas City, Kans.; P. E. Foster, Norco, La.
Asst. Supts., H. A. Stiles, Wood River, Ill.; J. L. Miller, East Chicago, Ind.; T. G. Elder, Houston, Tex.; P. E. Hurley, Arkansas City, Kans.; W. G. Horstman, Norco, La.
Tank Car S. M., R. D. Ebbert
Bulk Depots S. M., D. E. Lauin
Station S. M., H. E. Hall
Ch. Egr., S. Peterson
Ch. Chems., E. G. Travis, Wood River; E. B. Ayers, East Chicago; W. E. Robbins, Norco; R. C. Rich, Houston; R. L. Speer, Arkansas City.
Pur. Agt., C. B. Singleton
Traf. Mgr., E. W. Sieboldt
Refineries located at Wood River, Ill.; East Chicago, Ind.; Houston, Tex.; Arkansas City, Kans., and Norco, La.

Sherwood Petroleum Co., Inc., Bush Terminal Bldg. No. 1, Brooklyn, N. Y.
Pres., H. H. Sherwood
V. P.'s, V. L. Roberson, A. J. Glacel
Sec., James W. Jackson
Treas. and Pur. Agt., G. D'Amore
Gen. Mgr., V. L. Roberson
Gen. Supt., Arthur J. Franks
Supt., Geo. Henry, Warren, Pa.
Tank Car S. M., V. L. Roberson
Ch. Chem., Robert Parker
Traf. Mgr., M. Montalto
Refinery located at Warren, Pa.

Shoreline Oil Co., 31 S. Wabash Ave., Chicago, Ill.
Pres. and Treas., C. M. Leonard
V. P. and Sec., R. C. Burdick
Gen. Supt., N. R. Price
Sales Mgr., E. G. Youngbery
Pur. Agt., R. M. Brockett
Refinery located at Lewis, La.

Shore Line Refining Co., Kilgore, Tex.
Owner, A. V. Riley
Refinery located at Kilgore, Tex.

Signal Oil Co., 811 W. Seventh St., Los Angeles, Calif.
Pres., S. B. Mosher
V. P.'s, R. H. Green, O. W. March
Sec., H. J. March
Treas., J. H. Rounsavell
Ch. Egr., G. L. Young
Pur. Agt., J. H. Thies
Refinery located at Hynes, Calif.

Simms Oil Co., 1007 Magnolia Bldg., Dallas, Tex.
Pres., Edward T. Moore
V. P., F. R. Schneider
Sec., L. W. Richards
Treas., D. H. Voss
Gen. Mgr., Edw. T. Moore
Gen. Supt., I. H. Lance
Tank Car S. M., F. R. Schnieder
Ch. Egr., Frank Gardner
Ch. Chem., H. L. Kerr
Traf. Mgr., J. W. Ricker
Refineries located at Dallas, Tex., and Smackover, Ark.

Simrall Refining Corp., 511 Union Central Bldg., Cincinnati, Ohio
Pres., W. F. Simrall
V. P., R. P. Crothers
Sec. and Treas., A. A. Buschle
Gen. Mgr., W. F. Simrall
Ch. Egr., R. P. Crothers
Traf. Mgr., B. E. Kothe
Supt., E. H. Crawley, Horse Cave, Ky.
Refinery located at Horse Cave, Ky.

Sinclair Refining Co., 630 Fifth Ave., New York, N. Y. (Subsidiary of Consolidated Oil Corp.)
Chm. Board, H. F. Sinclair
V. Chm. Board, H. R. Gallagher
Pres., E. W. Sinclair
Asst. to Pres., Daniel J. Pierce
V. P.'s, J. W. Carnes, J. M. O'Day, Sheldon Clark, M. L. Gosney, H. L. Phillips, J. F. Farrell, E. W. Isom, L. V. Stanford, Geo. H. Taber, Jr., R. W. Raglans
Asst. Sec., O. M. Gerstung
Treas., J. F. Farrell
V. P. Chg. Ref., George H. Taber, Jr.
Gen. Supt., George R. Lord
Ch. Egr., J. S. Hess
Ch. Chem., E. B. Phillips
Pur. Agt., H. B. Malone
Traf. Mgr., J. M. O'Day
Tank Car and Station S. M., J. W. Carnes
Refineries located at East Chicago, Ind.; Coffeyville, Kans.; Houston, Tex.; Marcus Hook, Pa.; Wellsville, N. Y.; Sand Springs, Okla.; Fort Worth, Gladewater and El Paso, Tex.; Kansas City, Kans., and Parco, Wyo.

Skelly Oil Co., Skelly Bldg., Tulsa, Okla.
Pres., W. G. Skelly
V. P.'s, H. M. Stalcup, C. C. Herndon, W. T. Atkins, R. T. Lyons, Emby Kaye
Sec. and Treas., F. T. Hopp
Gen. Supt., K. J. Smith
Sales Mgr., W. T. Atkins
Supt., K. J. Smith, Eldorado, Kans.
Asst. Supt., H. V. Smith, Eldorado
Ch. Egr., Arthur Ayvazian
Ch. Chem., E. A. Todd
Pur. Agt., F. W. Robertson
Traf. Mgr., A. F. Winn
Refinery located at Eldorado, Kans.

Sloan & Zook Refining Co. (The), 101 Main St., Bradford, Pa.
Pres., R. T. Zook
V. P.'s, W. J. Sloan, P. H. Zook
Sec., C. T. Rickerson
Treas., W. J. Sloan
Gen. Mgr., Paul H. Zook
Gen. Supt., Paul I. Tinkler
Asst. Supt., Earl Dorrance
Tank Car S. M., Walter H. Murphy
Ch. Chem., T. C. Atwell
Refinery located at Warren, Pa.

Snow Cap Oil Co., Sunburst, Mont.
Sole Owner, Adam J. Eulberg
Refinery located at Sunburst, Mont.

Socal Oil & Refining Co., 1002 Rowan Bldg., Los Angeles, Calif.
Pres., C. A. Johnson
V. P., J. H. Grimes, Huntington Beach, Calif.
Sec., Paul Fussell
Treas., P. J. Hallicy, Huntington Beach
Supt., J. H. Grimes
Sales Mgr., W. E. Lanzer
Pur. Agt., J. H. Grimes
Refinery located at Huntington Beach, Calif.

OPERATING DIVISIONS OF SOCONY-VACUUM

Socony-Vacuum Oil Co., Inc., 26 Broadway, New York, N. Y.
Pres., J. A. Brown
V. P.'s, E. R. Brown, A. F. Corwin, Frederick Ewing, F. S. Fales, C. L. Jones, H. F. Sheets and C. E. Arnott
Sec., W. D. Bickham
Treas., F. S. Fales
Gen. Supt., Wilbur F. Burt
Supts., A. E. Esser, Brooklyn; R. T. Lockwood, Buffalo, N. Y.; C. W. Schaffer, Providence, R. I.; J. F. Turner, Olean, N. Y.; J. S. McElfresh, Paulsboro, N. J.
Asst. Supts., W. J. Mooney and F. W. Hadley, Brooklyn; F. S. Ford, Buffalo, N. Y.; H. A. Rickett, Providence, R. I.; W. E. Wanner, Olean, N. Y.; D. L. Hooker, Paulsboro, N. J.
Tank Car and Station S. M., Frederick Ewing
Ch. Egr., C. A. Ellis

Ch. Chem., Dr. J. B. Rather
Pur. Agt., J. R. Taylor
Traf. Mgr., L. H. Benner
Refineries located at Brooklyn, N. Y.; Buffalo, N. Y.; Olean, N. Y.; Providence, R. I.; Paulsboro, N. J.

Lubrite Division, 4140 Lindell Blvd., St. Louis, Mo.
Gen. Mgr., H. T. Ashton
Gen. Supt., D. A. Windsor
Supt., Chas. Bettman, E. St. Louis
Asst. Supt., James Hickey, E. St. Louis
Marketing Mgr., W. H. Ware
Tank Car S. M., Earl Whatley
Ch. Egr., R. A. Frevert
Ch. Chem., L. T. Doiron
Pur. Agt., J. H. MacCrea
Traf. Mgr., O. E. Kuster
Refineries located at E. St. Louis, Ill., and Wood River, Ill. (latter shut down)

White Eagle Division, 1400 Federal Reserve Bank Bldg., Kansas City, Mo.
Gen. Mgr., L. L. Marcell
Mgr., R. R. Irwin
Gen. Supt., E. C. Marshall
Supts., C. C. Durkee, Augusta, Kans.; J. W. Glass, Casper, Wyo.
Ch. Egr., G. S. Dunham
Ch. Chem., H. L. Bedell
Refineries located at Augusta, Kans., and Casper, Wyo.

White Star Division, 903 W. Grand Blvd., Detroit, Mich.
Gen. Mgr., H. A. Coffin
Asst. Gen. Mgr., C. B. McCollough
Exec. Asst., H. M. Sullivan
Gen. Supt., J. B. Edwards
Supt., S. G. Keller, Trenton, Mich.
Tank Car S. M., L. T. Morow
Station S. M., C. B. White
Ch. Egr., C. R. Miller
Ch. Chem., Dr. E. H. Potthoff
Pur. Agt., J. G. Pyke
Traf. Mgr., J. C. O'Brien
Refinery located at Trenton, Mich.

Solvex Refineries, Box 1168, Gladewater, Tex.
Pres., George Culver
V. P., M. L. Freese
Sec. and Treas., I. Arthur Anson
Supt., J. K. MacKinnon
Tank Car S. M., I. Arthur Anson
Ch. Chem., H. Caplan
Pur. Agt., M. L. Freese
Traf. Mgr., T. C. Clement
Refinery located at Gladewater, Tex.

Southern Oil Refining Co., Swann Bldg., Tyler, Tex.
Pres., L. H. Gray
V. P., J. S. Johnson
Sec. and Treas., N. L. Webster
Gen. Mgr., L. H. Gray
Supt., C. L. Harriman, Reeds, Tex.
Tank Car and Station S. M., N. L. Webster
Traf. Mgr., N. L. Webster
Pur. Agt., N. L. Webster
Refinery located at Reeds, Tex.

South Kentucky Pipe Line Co., Somerset, Ky.
Pres., R. C. Snyder
V. P., H. B. Wood
Sec. and Treas., Earl R. Tate
Gen. Supt., Dexter Parmley
Tank Car S. M., A. R. Anderson
Station S. M., L. I. Longsworth
Refinery located at Somerset, Ky.

Southport Refining Co., Kilgore, Tex.
Owner, Marion Travis
Refinery located at Kilgore, Tex.

Spartan Refining Co., Inc., Atlas Bldg., Shreveport, La.
Pres., E. R. Ratcliff
V. P., B. H. Gray
Gen. Supt., D. H. Christman
Asst. Supt., C. P. Christman
Tank Car S. M., Pleas O. Hardwick
Station S. M., W. S. Gray
Ch. Chem., H. O. Sivess
Pur. Agt., M. W. Bass
Traf. Mgr., J. S. Satterley
Refinery located at Shreveport, La

St. Helens Petroleum Co., Ltd., 1031 S. Broadway, Los Angeles, Calif.
Chm. Charles B. Stocken
Directors, William Ivey, A. F. Strickland
Sec., R. H. Young, London, England; L. A. Sec., A. P. McEachern
Gen. Mgr., Charles Drader
Supt., C. Z. Webb, Pico, Calif.
Asst. Supt., C. W. Spark, Pico, Calif.
Tank Car and Station S. M., M. F. Dolan
Pur. Agt., H. C. Drader
Traf. Mgr., R. M. Kennett
Refinery located at Pico, Calif.

Standard Gasoline Co., 225 Bush St., San Francisco, Calif.
Pres., K. R. Kingsbury
V. P.'s, W. H. Berg, R. W. Hanna, A. S. Russell
Sec., J. H. Tuttle
Treas., V. F. Palmer
Refinery located at Taft, Calif.

Standard Oil Co. of California, 225 Bush St., San Francisco, Calif.
Pres., K. R. Kingsbury
V. P.'s, W. H. Berg, R. W. Hanna, H. D. Collier, R. K. Davies
Sec., J. H. Tuttle
Treas., V. F. Palmer
Gen. Supt., A. F. Brooks
Supts., H. C. Hanna, El Segundo; C. F. Finney, Richmond; J. F. Faber, Bakersfield
Ch. Egr., H. H. Hall
Ch. Chem., J. B. Terry
Pur. Agt., F. D. Bryant
Traf. Mgr., A. R. Slingerland
Sales Mgr., H. B. Fairchild
Refineries located at El Segundo, Richmond, Bakersfield

Standard Oil Co. (Indiana), 910 South Michigan Ave., Chicago, Ill.
Pres., E. G. Seubert
V. P.'s, Allan Jackson, C. J. Barkdull, R. H. McElroy, A. W. Peake, E. J. Bullock, M. G. Paulus
Sec., F. T. Graham
Treas., C. J. Barkdull
V. P. in Chg. Mfg., M. G. Paulus
Gen. Supt., H. F. Glair
Supts., E. J. Shaeffer, Whiting, Ind.; S. A. Montgomery, Wood River, Ill.; G. H. Moffett, Sugar Creek, Mo.; H. R. Snow, Neodesha, Kans.; R. E. Beard, Casper, Greybull, Wyo.
V. P. in Chg. of Sales, Allen Jackson
Tank Car and Station S. M., Amos Ball
Dir. of Purchases, E. J. Bullock
Traf. Mgr., R. H. McElroy
Refineries located at Whiting, Ind.; Wood River, Ill.; Sugar Creek, Mo.; Neodesha, Kans.; Casper, Greybull and Laramie, Wyo.; Zilwaukee, Mich.

Standard Oil Co. of Louisiana, 2134 St. Charles Ave., New Orleans, La. (Subsidiary of Standard Oil Co. of New Jersey)
Pres., J. C. Hilton
V. P., Sec. and Treas., A. K. Gordon
V. P. and Gen. Mgr. Sales, J. E. Skehan
V. P. and Gen. Mgr. Mfg., M. J. Rathbone, Baton Rouge, La.
Gen. Supt., R. J. Stone, Baton Rouge, La.
Pur. Agt., W. N. Cottrell
Traf. Mgr., R. W. J. Flynn
Refinery located at Baton Rouge, La.

Standard Oil Co. of New Jersey, 26 Broadway, New York City, N. Y.
Pres., F. W. Abrams
V. P.'s, Chester F. Smith, C. G. Sheffield
Sec., M. H. Eames
Treas., R. P. Resor
Gen. Mgrs., J. R. Carringer, Northern Refineries; E. A. Rudigier, Southern Refineries
Supts., M. R. Meacham, Linden, N. J.; S. J. Tydeman, Bayonne, N. J.; W. A. Eberle, Jersey City; E. A. Rudigier, Baltimore; George W. Thompson, Parkersburg; J. E. Lenhardt, Charleston, S. C.
Tank Car S. M., E. A. Holbein
Retail S. M., C. G. Sheffield
Wholesale Sales Mgr., J. E. Skehan
Staff Egr., C. L. Waite
Ch. Chem., H. G. Burks, Jr.
Pur. Agt., J. W. Casterton
Traf. Mgr., A. G. Phelps
Refineries located at Bayonne, Linden, Jersey City, Baltimore, Parkersburg, Charleston, S. C.

Standard Oil Co. of Ohio, Sixteenth Floor, Midland Bldg., Cleveland, Ohio
Pres., W. T. Holliday
V. P.'s, A. M. Maxwell, A. A. Stambaugh, W. J. Semple, L. S. Bale
Sec., F. H. Kelly
Treas., W. J. Semple
Mgr. Ref., L. S. Bale
Supts., A. H. Buchanan, No. 1 Works, Cleveland; L. B. Helm, No. 2 Works, Cleveland; G. W. Hanneken, Toledo; E. A. Brown, Latonia, Ky.; J. R. Cuthbert, Lima, Ohio
Tank Car S. M., A. B. Nichols
Station S. M., A. A. Stambaugh
Pur. Agt., S. H. Elliott
Traf. Mgr., W. A. Wareing
Refineries—No. 1 Works, Cleveland, Ohio; No. 2 Works, Cleveland, Ohio; Toledo, Ohio; Latonia, Ky.; Solar Refinery, Lima, Ohio

Standard Oil Co. of Texas, 225 Bush St., San Francisco, Calif.
Pres., K. R. Kingsbury
V. P.'s, H. D. Collier, R. W. Hanna, G. E. Kennedy, A. S. Russell
Sec., J. H. Tuttle
Treas, V. F. Palmer
Refinery located at El Paso, Tex.

Stanolind Oil & Gas Co., Phileade Bldg., Tulsa, Okla.
Pres., F. O. Prior
V. P.s, A. M. McCorkle, E. F. Bullard
Sec. and Treas., F. J. Keleher
Gen. Supt., P. G. Weidner
Supt., O. W. White, Superior, La.
Tank Car S. M., F. J. Keleher
Act. Ch. Prod. Egr., John R. Evans
Pur. Agt., W. L. James
Traf. Mgr., F. J. Keleher
Refinery located at Superior, La.

Starlight Refinery Co., Karns City, Pa.
Pres., F. J. Pickard
V. P., W. B. Purvis
Sec., Howard I. Painter
Treas. and Gen. Supt., Clyde E. Pickard
Gen. Mgr., F. J. Pickard
Refinery located at Karns City, Pa.

Star Refinery, Osage, Wyo.
Gen. Mgr., Gretchen G. Ross
Refinery located at Osage, Wyo.

Steiner, Walter, Refining Co., 2132 South St., Long Beach, Calif.
Pres., Walter Steiner
V. P., Curtis Flint
Sec. and Treas., Adelaide Steiner
Salesman, Curtis Flint
Refinery located at Long Beach, Calif.

Sterling Refining Co., Box 114-A, Bell, Calif.
Gen. Mgr., Gould M. Fitch
Refinery located at Bandini, Calif.

Stockton Oil Co., Inc., 405 Montgomery St., San Francisco, Calif.
Pres. and Treas., G. H. Corse, Jr.
V. P. and Gen. Mgr., G. A. F. Bidwell
Sec., Victor Aaron
Tank Car and Station S. M., J. S. O'Connor
Ch. Egr. and Chem., T. D. Boyce
Refinery located at Stockton, Calif.

Stoll Oil Refining Co., Inc., 227 W. Main, Louisville, Ky.
Pres., C. C. Stoll
V. P. Chg. Sales, Geo. Stoll
V. P. Chg. Ref., Berry V. Stoll
V.P. Chg. Stations and Branches, Chas. E. Stoll
Sec. and Treas., Wm. A. Stoll
Supt., J. W. Kittner
Asst. Supt., Covington Arterburn
Tank Car S. M., J. J. Kirchner
Station S. M., C. E. Stoll
Ch. Chem., Clem S. Luce
Pur. Agt., John D. Crowdus
Traf. Mgr., Geo. E. Gill
Refinery located at Louisville, Ky.

Stone Oil Co., Second National Bank Bldg., Houston, Tex.
Pres., R. W. Stone
V. P., H. M. Stone
Sec. and Treas., Adelaide La Combe
Gen Supt., H. M. Stone
Refinery located at Texas City, Tex.

Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Pres., J. Howard Pew
V.P.s, J. N. Pew, Jr., J. Edgar Pew, S. B. Eckert, A. E. Pew, Jr.
Sec. and Treas., Frank Cross
Supts., W. D. Mason, Marcus Hook, Pa.; H. O. Cameron, Toledo, Ohio; C. B. Carter, Yale, Okla.
V. P. Chg. Sales, S. B. Eckert
Ch. Chem., Dr. Geliert Alleman
Refineries located at Marcus Hook, Pa., Toledo, Ohio, and Yale, Okla.

Sunray Oil Co., Philtower Bldg., Tulsa, Okla.
Pres., C. H. Wright
V. P., F. L. Martin
Sec., W. D. Forster
Treas., L. W. Bennett
Gen. Supt., F. L. Martin
Supt., R. L. Johnson, Allen, Okla.
Asst. Supt., A. D. Vinson
Tank Car S. M., F. L. Martin
Station S. M., J. G. Wright
Ch. Chem., J. B. Farfield
Ch. Egr., R. L. Johnson
Pur. Agt., R. E. Campbell
Traf. Mgr., J. B. Farfield
Refinery located at Allen, Okla.

Super Asphalt Products Co., Long Beach, Calif.
Pres. and Gen. Mgr., W. H. Geis
Refinery located at Long Beach, Calif.

Superior Oil Corp., Elsie, Mich.
Pres., H. J. Smith
Sec. and Treas., Rae W. Lewis
Gen. Mgr., Rae W. Lewis
Gen. Supt., R. C. Guy
Asst. Supt., Bert Miller
Tank Car S. M., Max Lewis
Station S. M., H. B. Crell
Refinery located at Elsie, Mich.

Superior Oil Works, 8 Hammond Road, Warren, Pa.
Pres., R. Z. Morrison
V. P., F. C. Eaton
Sec. and Treas., H. G. Eaton
Gen. Mgr., H. G. Eaton
Supt., H. S. Peterson
Asst. Supt., R. B. Allmendinger
Tank Car S. M., H. G. Eaton
Ch. Chem., R. B. Allmendinger
Pur. Agt., H. F. Cogswell
Traf. Mgr., C. H. Eaton
Refinery located at Warren, Pa.

Supreme Refining Co., Gladewater, Tex.
Owner, Nathan Lynch
Refinery located at Gladewater, Tex.

Sweet Oil Refining Co., Wyman, Mich.
Pres., H. H. Rice
V. P., Max Pray
Sec., H. T. Watson
Treas., A. C. Anderson
Gen. Mgr., Max Pray
Gen. Supt., Fred Case
Tank Car S. M., Max Pray
Ch. Chem., Ray Hall
Refinery located at Wyman, Mich.

T

Taxman Refining Co., Inc., Box 119, Wichita Falls, Tex.
Pres., J. J. Taxman
V. P., Maynard Taxman
Sec. and Treas., M. Taxman
Gen. Mgr., J. J. Taxman
Gen. Supt., J. E. Cochran
Tank Car S. M., Maynard Taxman
Station S. M., E. S. Taxman
Pur. Agt. and Traf. Mgr., C. W. Hubland
Auditor, G. L. Jones
Refinery located at Wichita Falls, Tex.

Taylor Refining Co., Taylor, Tex.
Pres., G. L. Rowsey
V. P., Ben H. Harrison
Sec., Harris A. Melaskey
Treas., Ben H. Harrison
Gen Mgr., G. L. Rowsey
Supt., J. B. Mayo, Taylor, Tex.
Tank Car S. M., G. L. Rowsey
Pur. Agt., Ben H. Harrison
Refinery located at Taylor, Tex.

Texas Co., The (California), 929 South Broadway, Los Angeles, Calif.
Pres. and Gen. Mgr., C. E. Olmsted, Los Angeles
V. P.s, J. A. Bermingham, Los Angeles; R. T. Herndon, Los Angeles; L. R. Holmes, Los Angeles; H. W. Dodge, New York
Sec., E. M. Crone, New York
Treas., C. E. Woodbridge, New York
Mgr. Ref., L. R. Holmes, Los Angeles
Supts., W. J. Ryan, Los Angeles; J. R. Scanlin, Fillmore, Calif.
Mgr. Sales Dept., R. T. Herndon, Los Angeles
Pur. Agt., A. F. Colling, New York
Refineries located at Los Angeles, Calif.; Fillmore, Calif., and Coalinga, Calif. (Last shut down).

Texas Co., The (Delaware), 135 East Forty-second St., New York City
Pres., W. S. S. Rodgers
V. P.'s, T. J. Donoghue, Houston; F. T. Manley, New York; G. L. Noble, Houston; R. Ogarrio, New York; H. W. Dodge and H. T. Klein, New York
Chm. Bd., T. Rieber
Sec., E. M. Crone, New York
Treas., C. E. Woodbridge, New York
Mgr. Ref. Dept., F. T. Manley, New York
Supts., F. P. Dodge, Gen. Supt., Port Arthur, Tex.; F. S. Dengler, Port Neches, Tex.; T. J. Landry, Houston; R. G. Collins, West Dallas; W. K. Holmes, West Tulsa; C. B. Bogart, Lockport, Ill.; R. H. Donaldson, Shreveport; H. C. Wakefield, Pryse, Ky.; A. E. Higgs, San Antonio; S. W. Darling, Amarillo; H. A. Fouts, El Paso, Tex.; L. F. J. Wilking, Casper, Wyo.; T. J. Davidson, Calpet, Wyo.; G. O. Shefstead, Craig, Colo.; L. F. J. Wilking, Cody, Wyo.; O. M. Webb, Sunburst, Mont.; J. R. Reed, Norfolk, Va.; C. G. Cramer, Claymont, Del.; V. B. Pevoto, Providence, R.I.
Domestic Sales Dept., H. W. Dodge, Gen. S. M., New York; W. L. Kallman, Mgr., Northern Territory, New York; J. S. Leach, Mgr., Southern Territory, Houston; S. B. Wright, Mgr., Central Territory, Chicago
Foreign Sales Dept., H. M. Herron, Gen. Mgr.
Pur. Agt., A. F. Colling, New York
Refineries located at Port Arthur, Tex.; Port Neches, Tex.; Houston, Tex.; West Dallas, Tex.; West Tulsa, Okla.; Lockport, Ill.; Shreveport, La.; Pryse, Ky.; San Antonio, Tex.; Amarillo, Tex.; El Paso, Tex.; Casper, Wyo.; Calpet, Wyo.; Cody, Wyo.; Sunburst, Mont.; Norfolk, Va.; Claymont, Del.; Providence, R. I. (Calpet, Wyo., plant operates as California Petroleum Corp. of Utah; Sunburst, Mont., plant operates as International Refining Co.)

Texas-Mexican Oil & Refining Co., Laredo, Tex.
Pres., M. T. Cogley
V. P., C. Edw. Cole
Sec. and Treas., Ralph Berry
Gen. Mgr., C. Edw. Cole
Refinery located at Laredo, Tex.

Texas Oil Products Co., Box 775, Gladewater, Tex.
Pres., C. R. Starnes
V. P., Glenn J. Smith
Sec. and Treas., E. L. Ames
Gen. Mgr., C. R. Starnes
Gen. Supt., F. N. Williams
Asst. Supt., W. F. Thomas
Tank Car S. M., W. C. McCallion
Ch. Chem., H. L. Kerr
Pur. Agt., E. L. Ames
Traf. Mgr., W. C. McCallion
Refinery located at Gladewater, Tex.

Texas Pacific Coal & Oil Co., Fort Worth National Bank Bldg., Fort Worth, Tex.
Pres., J. R. Penn
V. P.'s, John Hancock, R. J. Fleckenstein
V. P. Chg. Sales, O. E. Mitchell
Sec. and Treas., R. Seibel
Supt., D. B. Hiatt
Asst. Supt., C. S. Bronsted, Caddo, Tex.
Station S. M., Roy M. Naugle
Egr., D. J. Costa
Pur. Agt., Harris Pruitt
Traf. Mgr., E. A. Starr
Refinery located at Caddo, Tex.

Texas Petroleum Products Co., Somerset, Tex.
Pres., Grover C. Shaw
V. P., F. H. Witherspoon
Sec. and Treas., W. I. Lighthouse
Supt., G. B. Dartois
Refinery located at Somerset, Tex.

Tide Water Oil Co., 17 Battery Place, New York, N. Y.
Pres., Edward L. Shea
V. P.'s, Robert McKelvy, Noel Robinson, Edward H. Salrin
Sec., William J. Burker
Treas., K. R. Hankinson
Gen. Mgr. Ref., C. R. Barton
Supt., H. S. Chase, Bayonne
Wholesale and Export S. M., L. C. Quackenbush
Automotive S. M., J. D. Collins
Ch. Egr., R. S. Stanfield
Ch. Chem., J. T. McCoy
Pur. Agt., P. W. Fenton
Traf. Mgr., C. F. Dowd
Refinery located at Bayonne, N. J.

Tide Water Oil Co. (Oklahoma), Box 731, Tulsa, Okla.
Pres., E. L. Shea
V. P.'s, C. R. Barton, E. H. Salrin, R. B. Pringle, J. W. Warner, J. R. Gahan
Sec., Y. P. Broome
Treas., K. R. Hankinson
Supt., L. M. Jagou, Drumright, Okla.
Tank Car and Station S. M., J. W. Warner
Ch. Egr., O. A. Gierow
Ch. Chem., R. W. Boyd
Pur. Agt., M. F. Bridges
Traf. Mgr., C. F. Dowd
Refinery located at Drumright, Okla.

Tiona Refining Co., Clarendon, Pa.
Pres., W. C. Burns
V. P.'s, C. A. Boler, H. W. Walchli
Sec., G. P. McDonald
Treas., W. F. Dau
Gen. Supt., H. W. Walchli
Sales Mgr. and Pur. Agt., H. W. Walchli
Refinery located at Clarendon, Pa.

Toole County Refining Co., Oilmont, Mont.
Pres., G. C. Hoyt
Sec. and Treas., J. A. Coons
Refinery located at Oilmont, Mont.

Triangle Oil & Refining Co., 563 Washington Blvd., Venice, Calif.
Pres., G. A. Lathrop
V. P., L. W. Frankley
Sec. and Treas., C. W. Allison
Gen. Mgr., C. W. Allison
Gen. Supt., L. R. Taylor
Station S. M., F. H. Boston
Pur. Agt., H. S. Capron
Refinery located at Venice, Calif.

Triangle Producing & Refining Co., 905 Midwest Bldg., Oklahoma City, Okla.
Pres. and Treas., D. L. Kelly
V. P. and Sec., E. C. Chech
Gen. Mgr., E. C. Chech
Gen. Supt., P. L. Bergman
Sales Mgr., G. L. Malherbe
Pur. Agt., D. L. Kelly
Traf. Mgr., G. L. Malherbe
Refinery located at Oklahoma City, Okla.

Trinity Refining Co., P.O. Box 146, Fort Worth, Tex.
Pres., R. B. Farris
V. P.'s, Dr. C. D. Halley, R. A. Stuart
Sec., F. L. Mitchell
Gen. Mgr., R. B. Farris
Gen. Supt., W. M. Paull
Prod. Supt., W. F. Hurst
Tank Car S. M., P. L. Jennings
Traf. Mgr., John E. Haynes
Refinery located at Gladewater, Tex.

Trio Refining Co., Arp, Tex.
Owner, M. J. Grogan
Refinery located at Arp, Tex.

Tri-State Refining Co., Ashland, Ky.
Pres., Paul G. Blazer
V. P., E. F. Wells
Sec., E. L. McDonald
Treas., E. W. Seaton
Gen. Mgr., Paul G. Blazer
Gen. Supt., F. W. Irwin
Tank Car S. M., E. F. Wells
Station S. M., A. A. Hines
Ch. Egr., C. C. Compton
Pur. Agt., M. K. Lovell
Ch. Chem., C. O. Garbrecht
Traf. Mgr., P. H. Banks
Refinery located at Kenova, W. Va.

Troy Refining Corp., Trop, Ind.
Pres., Auburn Stinson
V. P., C. D. Schreiber
Sec. and Treas., Dewey Stinson
Gen. Mgr., Dewey Stinson
Gen. Supt., M. R. Rippy
Station S. M., W. T. Anderson
Ch. Chem., M. R. Rippy
Refinery located at Troy, Ind.

Tucker Oil Co., Wichita Falls, Tex.
Pres., J. J. Perkins
V. P., Charles J. Tucker
Sec. and Treas., Harold Murph
Gen. Mgr., Charles J. Tucker
Gen. Supt., Charles J. Tucker
Supt., L. B. Horr, Box 212, Thrift, Tex.
Sales Mgr. (bulk), Charles J. Tucker
Ch. Chem., J. Dickson, Box 245, Burkburnett, Tex.
Pur. Agt., L. B. Horr
Refinery located at Burkburnett, Tex.

Tyler Texas Oil & Refining Co., Tyler, Tex.
Pres., P. J. McMurray
V. P., Marvin McMurray
Sec. and Treas., A. D. Blackwell
Refinery located at Tyler, Tex.

Tyreco Refining Co., Box 395, Arp, Tex.
Pres., Dick Duncan
V. P., Erroll C. Holt
Sec. and Treas., Errol C. Holt
Gen. Mgr., R. T. Bowen
Sales Mgr., R. T. Bowen
Supts., C. Zimmerman, Arp, Tex.; C. J. Constantin, Overton, Tex.
Pur. Agt., Lyter Witherspoon
Refineries located at Arp and Overton, Tex.

U

Ultra-Penn Refining Co., Bruin, Pa.
Pres., H. C. Eaton
V. P., H. H. Phillips
Sec. and Treas., F. C. Dodds
Gen. Mgr., H. C. Eaton
Gen. Supt., W. G. Wagner
Asst. Supt., C. J. McCorry
Tank Car S. M., S. L. Gehr
Ch. Chem., W. R. Storey
Traf. Mgr., J. A. Hall
Refinery located at Bruin, Pa.

Union Oil Co. of California, 617 West Seventh St., Los Angeles, Calif.
Pres., L. P. St. Clair
Exec. V. P., R. D. Matthews
V. P.s, W. W. Orcutt, W. L. Stewart, Jr., Paul M. Gregg
Asst. V. P., A. C. Galbraith
Sec., W. R. Edwards
Asst. Secs., E. H. Estill, A. W. Milford
Comptroller, G. H. Forster
Asst. Compts., A. H. Hand, M. G. Kerr, A. B. Mason
Treas., J. M. Rust
Asst. Treas., A. C. Marshall, H. W. Sanders
Director of Mfg., R. E. Haylett
Mgr. Ref., L. G. Metcalf
Supts., A. Roy Heise, Oleum; R. W. Frazier, Avila; H. Ambrosier, Maltha (Bakersfield); C. W. Burtless, Santa Paula; John Salmond, Wilmington (Los Angeles)
Dir. of Sales, V. H. Kelly
Mfg. Ref. Oil Sales, J. M. Geary
Devel. Egr., Earle W. Gard
Mgr. Research, Dr. D. R. Merrill
Mgr. Purchases, H. C. Farquhar
Dir. Trans., William Groundwater
Refineries located at Oleum, Avila, Maltha (Bakersfield), Santa Paula, Wilmington (Los Angeles), Calif.

Union Refining Co., Camp Switch, Tex.
Pres., H. J. Strief
V. P., Roy Davis
Sec., C. M. Zinc
Refinery located at Camp Switch, Tex.

United Refining Co., 124 Dobson Ave., Warren, Pa.
Pres., E. G. Bannerot
V. P., H. A. Logan
Sec., H. W. Schmidt
Treas. and Gen. Mgr., H. A. Logan
Asst. Supt., John S. Cameron
Tank Car S. M., H. A. Logan and H. W. Schmidt
Prod. Egr., MacLean Houston
Ch. Chem., Herbert Wagner
Traf. Mgr., Ralph E. Brasington
Refinery located at Warren, Pa.

Unity Petroleum Corp., P. O. Box 391, Shelby, Mont.
Pres., Boris A. S. Aronow
Gen. Mgr., Boris A. S. Aronow
Supts., Ed Styren, Kalispell, Mont.; Roy Sticka, Havre, Mont.
Sales Mgr. and Pur. Agt., Boris A. S. Aronow
Refineries located at Kalispell, Mont., and Havre, Mont.

Upshur Refining Co., Inc., Box 676, Gladewater, Tex.
Pres., F. R. Jackson
V. P., Mrs. P. B. Goodwin
Sec., H. Melton
Treas., P. W. Leland
Gen. Mgr., F. R. Jackson
Sales Mgr., H. Melton
Pur. Agt., C. F. Linsey
Ch. Chem., J. L. Jones
Refinery located at Gladewater, Tex.

Utah Oil Refining Co., 10 West Broadway, Salt Lake City, Utah. Subsidiary of Standard Oil Co. (Indiana)
Pres., T. A. Dines
V. P.s, William R. Wallace, A. N. Johnson, M. J. Greenwood, E. S. Holt
Sec. and Treas., A. N. Johnson
Supt., E. S. Holt
Asst. Supt., Frank R. Clark
Tank Car S. M., M. J. Greenwood
Bulk Station S. M., A. S. Brown
Ch. Chem., Gordon I. Kirby
Pur. Agt. and Traf. Mgr., W. H. Lovesy
Refinery located at Salt Lake City, Utah

Utah Refining Co., Kilgore, Tex.
Owners, J. C. Potter, Julian Potter
Refinery located at Kilgore, Tex.

V

Valley Refining Co., P. O. Box 11, Harlingen, Tex.
Partnership, A. B. White and L. O. Blocker
Gen. Mgr., A. B. White
Supt. and Ch. Chem., C. R. McGinnis
Asst. Supt., Eddie Day
Sales Mgr. and Pur. Agt., A. B. White
Refinery located at Harlingen, Tex.

Valley Refining Co., East College Blvd., Roswell, N. Mex.
Pres., S. W. Lodewick
V. P., H. C. Buchly
Sec. and Treas., S. P. Johnson, Jr.
Gen. Mgr., S. W. Lodewick
Gen Supt., E. A. Wahline
Refinery located at Roswell, N. Mex.

Valvoline Oil Co., Fifth and Butler Sts., Cincinnati, Ohio
Pres., H. W. Edwards
V. P. and Gen. Mgr., C. J. Leroux
V. P.s, H. M. Hart, C. C. Gould, C. W. Luton, J. H. Garlough, V. L. Abbey
Sec., C. C. Gould
Treas., C. J. Leroux
Gen. Supt., C. W. Luton
Supts., Arthur Hagen, Butler, Pa.; Henry Winkler, Franklin, Pa.
Tank Car S. M., Harold Dunmire
Station S. M., W. Wasterson and C. E. McBurney
Ch. Egr., Louis Calkins
Ch. Chem., D. A. Smith
Pur. Agt., E. H. Shepherd, Cincinnati, Ohio, and K. Wychoff, New York, N. Y.
Traf. Mgr., E. A. Barror, Butler, Pa.
Refineries located at Butler and Franklin, Pa.

Vickers Petroleum Co. of Delaware, Wheeler-Kelly-Hagny Bldg., Wichita, Kans.
Pres., J. A. Vickers
V. P., C. L. Henderson
Sec. and Treas., J. S. Wertz
Gen. Mgr., C. L. Henderson
Supt., A. M. Schrepfer, Potwin, Kans.
Tank Car S. M., Myers Gross
Ch. Chem., A. M. Schrepfer
Pur. Agt. and Traf. Mgr., H. G. Shaw
Refinery located at Potwin, Kans.

W

Wadhams Oil Co., 907 First St., Milwaukee, Wis. (Subsidiary of Socony-Vacuum Corp.)
Chm. Bd., A. G. Maguire
Pres., H. W. Dodge
V. P.s, Henry J. Stolz, Louis McNally, J. M. McLaughlin, M. G. Peeters
Sec., R. P. Schwalbach
Treas., R. W. Fritzke, Jr.
Gen. Mgr., Henry J. Stolz
Gen. Supt., Wm. Hildebrandt, E. Chicago, Ind.
Ch. Chem., J. A. Hart, East Chicago, Ind.
Pur. Agt., H. A. Steffen, Milwaukee, Wis.
Refinery located at East Chicago, Ind.

Waggoner Refining Co., Inc., Box 107, Electra, Tex.
Pres., G. L. Waggoner
V. P., E. P. Waggoner
Sec. and Treas., R. L. More
Mgr., D. G. Gray
Supt., H. A. Mitchell
Tank Car S. M., H. D. Jenkins
Station S. M., R. F. Schmann
Ch. Egr., H. A. Mitchell
Ch. Chem., G. A. Birdsall
Pur. Agt., J. T. McNamara
Traf. Mgr., O. L. Ely
Refinery located at Electra, Tex.

Warr-Penn Refining Co., Warren, Pa.
Pres., E. W. Campbell
V. P., L. B. Schofield
Sec., E. N. Jacobson
Treas. and Gen. Mgr., George W. Campbell
Gen. Supt., C. Peterson
Asst. Supt., G. Peck
Tank Car S. M., George W. Campbell
Ch. Chem., F. Alginger
Pur. Agt., George W. Campbell
Traf. Mgr., L. B. Gordon
Refinery located at Warren, Pa.

Wasatch Oil Refining Co., 815 McIntyre Bldg., Salt Lake City, Utah
Pres., Wm. H. McIntyre
V. P., Henry D. Moyle
Sec., T. T. Little
Treas., Wm. Yeates
Supt., C. B. Owen
Asst. Supt., Glen Kennick
Refinery located at Woods Cross, Utah

Waverly Oil Works Co., Fifty-fourth St. and A.V.R.R., Pittsburgh, Pa.
Pres., S. M. Vockel
V. P.s, G. E. Willey, W. H. Millhiser
Sec., R. W. Winter
Treas., S. K. Cunningham
Gen. Mgr., W. H. Millhiser
Gen. Supt., W. H. Millhiser
Gen. Sales Mgr., J. F. King
Ch. Chem., W. T. Sieber
Pur. Agt., W. H. Millhiser
Traf. Mgr., S. Fox
Refineries located at Pittsburgh, Pa.

Wayco Refining Co., 409 Griswold St., Detroit, Mich.
Pres., John N. Stalker
V. P. and Gen. Mgr., Andrew G. Schlee
Sec. and Treas., Harry Eberline
Supt., J. J. Curren, Toledo, Ohio
Tank Car and Station S. M., Edward F. Schlee
Ch. Egr., Fred Schaeffer
Ch. Chem., Marvin J. Galvin
Pur. Agt., Andrew G. Schlee
Refinery located at Toledo, Ohio

Western Oil & Refining Co., 416 West Eighth St., Los Angeles, Calif.
Receiver, Robert C. Gillis
Pres., Richard Florian
V. P.s, A. W. Taylor, R. R. Rakestraw
Sec. and Treas., A. A. G. Scherbel
Asst. Sec. and Treas., L. J. Hart
Gen. Mgr., Frank E. Lee, Agent for Robert C. Gillis, Receiver
Gen. Supt., R. R. Rakestraw
Supt., O. C. Smith
Asst. Supt., H. H. Spangler
Tank Car and Station S. M., A. W. Taylor
Ch. Egr., E. J. McKee
Ch. Chem., H. H. Spangler
Pur. Agt., R. C. Ewing
Refinery located at Wilmington, Calif.

West Texas Refining Co., 1405 Tower Petroleum Bldg., Dallas, Tex.
Pres., F. W. Burford
V. P., John J. Thomas
Sec., John R. Scott
Treas., E. V. Campbell
Gen. Mgr., John J. Thomas
Tank Car S. M., Ralph E. Bishop
Station S. M., J. B. Cashell
Pur. Agt., W. M. Bisett
Traf. Mgr., A. L. Heine
Refinery located at Pecos, Tex.

Wheatland Refining Co., Wheatland, Wyo.
Sole owner, B. R. Brown

White Star Oil & Refining Co., 2400 Artesia Blvd., North Long Beach, Calif.
Pres. and Gen. Mgr., D. R. Wilson
Refinery located at Long Beach, Calif.

Wickett Refining Co., Wickett, Tex.
Pres., W. B. Hassett, St. Louis, Mo.
V. P., George W. Buckner, Dallas, Tex.
Sec. and Pur. Agt., T. D. Warner
Treas., George W. Buckner
Supt., J. T. Reardon
Tank Car S. M., J. B. Saunders, Clayton, Mo.
Traf. Mgr., F. O. Moore, Clayton, Mo.
Refinery located at Wickett, Tex.

Wilcox, H. F., Oil & Gas Co., Sixth and Denver St., Tulsa, Okla.
Pres., Homer F. Wilcox
V. P. and Gen. Mgr., G. A. Dye
V. P. and Treas., M. P. Appleby
V. P. Chg. Ref., F. H. Dunn
Sec., L. J. Yarbrough
Supt., W. M. Fraser, Bristow, Okla.
Tank Car S. M., T. H. Riggin
Station S. M., L. G. Murrell
Ch. Chem., Lester Borthick
Pur. Agt., H. B. Ward
Traf. Mgr., T. H. Riggin
Refineries located at Bristow, Okla.

Wilshire Oil Co., 2455 East Twenty-seventh St., Los Angeles, Calif.
Pres., George R. Machris
V. P. and Sec., Alfred P. Machris
Refineries located at Vernon (Los Angeles) and Bandini, Calif.

Wolverine-Empire Refining Co., 51 Madison Ave., New York City and Oil City, Pa.
Chm. Bd. and Gen. Mgr., E. W. Chase, Oil City, Pa.
Pres., C. H. Ellingwood, New York
V. P. and Sec., A. W. Scott, Oil City
Treas., F. W. Baer, New York
Gen. Supt., A. W. Cole, Reno, Pa.
Asst. Supt., M. F. Spencer, Tidioute, Pa.
Bulk S. M., O. P. Keeney
Ch. Chem., W. B. Smith, L. M. Baltzell, Asst.
Pur. Agt., W. J. Scott
Traf. Mgr., L. R. Cavanaugh
Refineries located at Reno, Pa., and Tidioute, Pa.

Wood-Moore Corp., Philtower Bldg., Tulsa, Okla.
Pres. and Gen. Mgr., A. F. Wood
V.P. and Sec., Dale W. Moore
Treas., Walter Payne, Jr.
Gen. Supt., L. M. McKinney
Ch. Egr., D. A. Price
Refinery located at Port Lavaca, Tex.

Wyoil Refining Co., Con.-Roy Bldg., Casper, Wyo.
Pres., George W. Jarvis
V. P.s, H. B. Durham, Chas. Ansa
Sec. and Treas., J. T. Scott
Gen. Supt., Paul Lowrey
Refinery located at Mills (suburb of Casper), Wyo.

Wyoming Gas & Oil Co., Osage, Wyo.
Gen. Mgr., C. F. Martens
Supt., Mike Materi
Refinery located at Osage, Wyo.

Y

Yale Oil Corp., Yale, Okla.
Pres., L. B. Hancock
V. P., Rob Hancock
Sec. and Treas., F. B. Hancock
Gen. Supt., W. Shaw
Tank Car S. M., F. B. Hancock
Traf. Mgr., C. R. Ramsey
Refinery located at Yale, Okla.

Yale Oil Corp. of South Dakota, Billings, Mont.
Pres., L. B. Hancock
V. P., P. N. Fortin, Billings
Supt., D. D. Gibson, Billings
Sales Supervisors, L. P. Barney, H. L. Hitchcock
Ch. Engr. and Chem., T .R. Corbett
Refineries located at Billings and Miles City, Mont.

Yuba Oil Co., Nacogdoches, Tex.
Pres., Geo. E. Ginter
V. P., J. B. Morton
Sec. and Treas., M. L. Ginter
Gen. Mgr., Geo. E. Ginter
Gen. Supt., I. D. Power
Ch. Chem., W. W. Grim

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UNITED STATES STEEL

Refineries Operating in the United States

Explanation of Terms Used in Operating Survey

(Comp.)—Complete plant, gasoline, kerosene, gas oil, fuel oil, lubricating oils, paraffin, wax, petroleum coke, asphalt or both coke and asphalt, usually includes cracking. Some plants listed as complete do not manufacture asphalt or coke.
(S)—Gasoline, kerosene distillate, gas oil and fuel oil.
(L)—Gasoline, kerosene distillate, gas oil, fuel oil, and lubricating oils.
(A)—Gasoline, kerosene distillate, gas oil, fuel oil and asphalt.
(T)—Tops, distillates, gas oil and fuel oil.
(C)—Same products as skimming, except equipped for cracking.
(W)—Wax.
Where plant includes cracking, lubricating oil and asphalt, (S) is omitted as skimming is implied.
(Crude Cap.)—Maximum number of barrels of crude plant is able to process daily.
(Gasoline Cap.)—Maximum number of barrels of gasoline the plant is able to make daily, including natural gasoline needed in blend.

ARKANSAS

Company and plant location—	Crude oil cap.	Gasoline cap.	Type of refinery	Type of cracking plant
Berry Asphalt Co., Waterloo	2,000	.....	A-L	
Henry H. Cross Co., Smackover	6,000	.....	C-L	Donnelly
Lion Oil Ref. Co., El Dorado	15,000	3,000	C	Lion
Macmillan Pet. Prod. Co., Norphlet	2,500	.....	L-A	
Root Ref. Co., El Dorado	12,000	7,000	C	Dubbs, Root
Total	37,500			

CALIFORNIA

Ajax Oil & Ref. Co., Long Beach	3,000	.....	C-A	
Associated Oil Co., Associated	48,000	18,000	Comp.	Tube and Tank
Associated Oil Co., Wilmington	9,500	2,000	C	Tube and Tank
Bachman Pet. Corp., Long Beach	2,000	700	S	
Bell View Oil Syndicate, Santa Fe Spgs.	2,500	.....	S	
Bush, R. R., Refinery, Long Beach	4,000	1,200	S	
California Ref. Co., Seal Beach	2,500	700	S	
Cameron, J. D., Taft	350	50	T	
Caminol Co., Ltd., Santa Fe Springs	4,500	1,400	S	
Caminol Co., Ltd., Hanford	2,500	1,200	S	
Capitol Crude Oil Co., Santa Paula	150	.....	S	
Casmite Co., Casmalia	1,000	.....	A	
Eagle Oil & Ref. Co., Santa Fe Springs	1,000	.....	S	
Edington Oil & Ref. Co., Long Beach	4,500	1,200	S	
Elm Oil Co., Ltd., Long Beach	1,800	500	S	
Envoy Pet. Co., Long Beach	3,000	.....	S	
Estado Pet. Corp., Ltd., Long Beach	6,000	2,000	S	
Exeter Ref. Co., North Long Beach	10,000	2,500	L-A	
General Pet. Corp., Vernon	28,000	7,000	S-L	
General Pet. Corp., Torrance	35,000	10,100	C	Kellogg
General Pet. Corp., Lebec	12,000	900	S	
Gilmore Oil Co., Ltd., Los Angeles	2,500	500	A	
Gilmore Oil Co., Ltd., Roadamite	1,500	100	A	
Golden Bear Oil Co., Oildale	500	.....	C-L	Vacuum
Hancock Oil Co., Long Beach	12,500	2,850	S	
Kolingo Refining Co., Coalinga	200	.....	L	
Lake View Oil & Ref. Co., Maricopa	3,000	.....	S	
Los Angeles Ref. Co., Bandini	3,000	800	S	
Macmillan Pet. Corp., Long Beach	8,500	3,000	S	
McOwen, Howard A., Long Beach	2,000	600	S	
Mercury Pet. Corp., Venice	3,000	700	A	
Mohawk Pet. Co., Bakersfield	3,000	.....	S-A	
Monarch Refineries, Playa Del Rey	2,500	.....	S	
Norwalk Co., Maricopa	3,000	1,000	S	
Olympic Ref. Co., Long Beach	6,000	.....	S	
Paraffine Co., Inc., Emeryville	1,200	.....	A	
Petrol Corp., Los Angeles	8,000	.....	A-L	
Pioneer Paper Co., Vernon	700	.....	A	
Posolube Ref. Co., Los Angeles	100	.....	A	
Rice Ranch Oil Co., Santa Maria	800	.....	A	Vapor Phase
Richfield Oil Co., Watson	40,000	.....	Comp.	Black
Richfield Oil Co., Hynes	55,000	.....	C	Cross
Rio Grande Oil Co., Vinvale	10,000	.....	C	Sinclair
San Fernando Ref. Co., Newhall	2,000	255	A	
Savon Oil & Ref. Co., Bakersfield	240	.....	L	
Seaside Oil Co., Ventura	5,000	1,500	A	
Shell Oil Co., Wilmington	35,000	.....	C-A	Dubbs
Shell Oil Co., Martinez	36,500	.....	Comp.	Dubbs
Shell Oil Co., Coalinga	3,800	.....	S	
Shell Oil Co., Dominguez	.....	.....	C	Dubbs
Socal Oil & Ref. Co., Huntington Beach	3,000	.....	S	
Standard Oil Co. of Calif., Richmond	100,000	50,000	Comp.	Dubbs

CALIFORNIA (Continued)

Company and plant location—	Crude oil cap.	Gasoline cap.	Type of refinery	Type of cracking plant
Standard Oil Co. of Calif., El Segundo	100,000	38,000	Comp.	Dubbs
Standard Oil Co. of Calif., Bakersfield	25,000	6,000	A	
Sterling Ref. Co., Bandini	750	.....	S	
St. Helens Pet. Co., Ltd., Pico (Los Angeles County)	5,000	900	A	
Stockton Oil Co., Inc., Stockton	2,500	800	T	
Super Asphalt Products Co., Long Beach	500	.....	A	
Terra Bella Ref. Co., Ltd., Terra Bella	400	.....	L	
Texas Co. (Calif.), Los Angeles	30,000	.....	C	Holmes-Manley
Texas Co. (Calif.), Fillmore	4,000	.....	C	Cross
Triangle Oil & Ref. Co., Venice	3,000	900	T	
Union Oil Co. (Calif.), Wilmington	55,000	15,000	C-A	Cross*
Union Oil Co. (Calif.), Oleum	17,000	3,700	A-L	
Union Oil Co. (Calif.), Bakersfield	5,000	1,500	A	
Union Oil Co. (Calif.), Santa Paula	1,200	300	S	
Walter Steiner Ref. Co., Long Beach	1,500	.....	L	
Western Oil & Ref. Co., Wilmington	12,000	.....	C	Jenkins
White Star Oil & Ref. Co., Long Beach	1,500	.....	S	
Wilshire Oil Co., Vernon	20,000	.....	S	
Total	852,990			

*Plant also includes seven residuum topping and viscosity units having charging capacity of 22,000 bbls. daily.

COLORADO

Continental Oil Co., Florence	2,000	1,068	C	Burton
Continental Oil Co., Denver	1,500	1,085	C	Cross
McGarr Pet. Corp., Kline	180	.....	S	
Midland Oil Ref. Co., Denver	1,500	.....	A	
Raven Oil & Ref. Co., Rangely	150	40	S	
Texas Co., Craig	1,000	.....	C	Holmes-Manley
Total	6,330			

DELAWARE

Texas Co., Claymont	2,000	.....	A	

GEORGIA

Atlantic Ref. Co., Brunswick	5,000	2,500	Comp.	Lewis
Pan American Pet. & Trans. Co., Savannah	4,000	.....	A	
Total	9,000			

ILLINOIS

Cross, Henry H. Co., Joliet	2,000	.....	S	
Cross, Henry H., Co., Dupo	1,000	.....	S	
Cross, Henry H., Co., Colmar	1,000	.....	S	
Globe Oil & Ref. Co., Lemont	12,000	8,100	C	Winkler-Koch
Indian Ref. Co., Lawrenceville	16,000	8,000	Comp.	Cross, deFlorez
Ohio Oil Co., Robinson	10,000	5,000	Comp.	Holmes-Manley
Red River Ref. Co., Inc., Burnham	1,200	.....	L	
Shell Pet. Corp., Wood River	38,000	14,000	Comp.	Dubbs, T.V.P., Cross
Socony-Vacuum Oil Co., Inc., (Lubrite) East St. Louis	5,000	3,600	S-C	Pratt Vapor Phase, Cross
Standard Oil Co. (Indiana), Wood River	17,000	.....	Comp.	Holmes-Manley
Texas Co., Lockport	20,000	.....	Comp.	Holmes-Manley deFlorez, Pressure Coke
Total	123,200			

INDIANA

Empire Oil & Ref. Co., East Chicago	25,000	20,000	C	Doherty
Shell Pet. Corp., East Chicago	30,000	16,000	C-A	Dubbs
Sinclair Ref. Co., East Chicago	40,000	.....	Comp.	Sinclair 600
Standard Oil Co. (Indiana), Whiting	93,000	.....	Comp.	Holmes-Manley, Continuous Combination
Troy Ref. Co., Troy	150	.....	A	
Wadhams Oil Co., East Chicago	7,200	.....	C	Kellogg
Total	195,350			

KANSAS

Barnsdall Refineries, Inc., Wichita	5,000	3,000	C	Dubbs
Cusco Oil & Ref. Co., Chase	3,000	1,200	S	
Derby Oil Co., Wichita	8,000	3,050	C-A	Dubbs
Dickey Ref. Co., McPherson	3,500	1,100	C	Gasoline Products

KANSAS (Continued)

Company and plant location—	Crude oil cap.	Gasoline cap.	Type of refinery	Type of cracking plant
El Dorado Ref. Co., El Dorado	5,000	3,000	C	Winkler-Koch
Falcon Refining Co., Great Bend	800	550	S	
Fredonia Oil & Ref. Co., Fredonia	250	100	S	
Globe Oil & Ref. Co., McPherson	12,000	6,600	C	Winkler-Koch
Golden Rule Ref. Co., Wichita	1,000	.....	C	Jenkins
Kanotex Ref. Co., Arkansas City	12,000	.....	C	Donnelly
Kansas Gasoline Co., Winfield	500	.....	S	
Kreuger Refining Co., Laton	150	.....	S	
National Ref. Co., Coffeyville	8,000	3,000	Comp.	National
Petroleum Products Co., Chanute	1,000	.....	S	
Phillips Pet. Co., Kansas City	18,000	.....	C	Dubbs, Own
Russell Ref. Co., Russell	2,500	280	S	
Shell Pet. Corp., Arkansas City	20,000	6,000	C	Dubbs
Sinclair Ref. Co., Coffeyville	12,000	.....	Comp.	Sinclair 600
Sinclair Ref. Co., Kansas City	11,000	.....	C	Sinclair 600
Skelly Oil Co., El Dorado	20,000	13,800	C-A	Winkler-Koch
Socony-Vacuum Oil Co., Inc., (White Eagle), Augusta	15,000	8,625	Comp.	White Eagle
Standard Oil Co. (Indiana), Neodesha	7,500	.....	C	Holmes-Manley Cracking Coil
United Oil & Ref. Co., Hutchinson	1,500	.....	S	
Vickers Pet. Co., Potwin	3,500	.....	C	Dubbs
Total	171,200			

KENTUCKY

Aetna Oil Service, Inc., Louisville	2,000	.....	C	Fleming
Ashland Ref. Co., Inc., Catlettsburg	4,700	2,700	C-A	Dubbs
Bowling Green Ref. Co., Memphis Junc.	1,500	.....	S	
Glasgow Oil & Ref. Co., Glasgow	250	.....	S	
Greenville Ref. Co., Greenville	100	3	S	
Louisville Ref. Co., Inc., Louisville	4,500	2,500	C	Dubbs
Simrall Ref. Corp., Horse Cave	2,500	.....	S	
South Kentucky Pipe Line Co., Somerset	400	100	S	
Standard Oil Co. (Ohio), Latonia	8,000	5,000	C-A	Tube and Tank
Stoll Oil Ref. Co., Louisville	2,500	.....	Comp.	Own
Texas Co., Pryse	2,500	.....	C	Holmes
Total	28,950			

LOUISIANA

Bayou State Ref. Corp., Hosston	750	.....	L	
Chalmette Pet. Corp., Chalmette	7,500	2,000	C	Winkler-Koch
Griswold Refineries, Sandra	5,000	.....	S	
Griswold Refineries, Shreveport	2,500	1,500	S	
Louisiana Oil Ref. Corp., Bossier City	23,000	11,259	C	Tube and Tank
Oil Refineries, Inc., Haughton	1,000	.....	S	
Pan American Southern Corp., Destrehan	16,000	.....	A	
Rodessa Oil & Ref. Corp., Cedar Grove	7,500	.....	C	
Shell Pet. Corp., Norco	21,000	8,000	C-A	Dubbs
Shoreline Oil Co., Lewis	2,000	.....	C-L-A	Vacuum
Spartan Ref. Co., Shreveport	12,000	6,000	C	Gyn
Stanolind Oil & Gas Co., Superior	4,500	.....	C	Cross
Standard Oil Co. of La., Baton Rouge	90,000	37,500	Comp.	Tube and Tank
Texas Co., Ardis (Shreveport)	7,000	.....	T	
Total	199,750			

MARYLAND

Continental Oil Co., Baltimore	10,000	5,694	C-A	Dubbs, Cross
Pan American Pet. & Trans. Co., Baltimore	8,000	.....	A	
Standard Oil Co. of New Jersey, Baltimore	37,000	16,450	Comp.	Tube and Tank
Total	55,000			

MASSACHUSETTS

Cities Service Ref. Co., East Braintree	20,000	10,000	Comp.	Doherty, Holmes-Manley
Colonial Beacon Oil Co., Everett	28,000	7,000	C-A	Tube and Tank
Total	48,000			

MICHIGAN

American Petro-Chemical Co., Wayne	1,200	600	C	Own
Century Ref. Co., Alma	2,500	1,340	C	Dubbs
Crystal Ref. Co., Carson City	1,500	.....	S	
Inland Refineries, Inc., Drayton Plains	1,500	450	S	
Kent Ref. Co., Grand Rapids	1,000	250	S	
Keystone Oil Ref. Co., Detroit	2,000	800	L	
Lakeland Ref., Inc., Trowbridge	*1,500	450	S	
Max Pray, Wyman	1,000	.....	S	
McClanahan Refs., Inc., St. Louis	3,500	2,500	C	Dubbs
Midwest Refs., Inc., Alma	2,000	990	S	
Naph-Sol Ref. Co., Muskegon	2,500	.....	C	Dubbs
Old Dutch Ref. Co., Muskegon	3,000	.....	S	
Pure Oil Co., Midland	3,500	1,200	T	
Roosevelt Oil Co., Mount Pleasant	5,000	833	L	
Socony-Vacuum Oil Co., Inc., (White Star), Trenton	10,500	8,000	C	Dubbs, Vapor Phase

MICHIGAN (Continued)

Company and plant location—	Crude oil cap.	Gasoline cap.	Type of refinery	Type of cracking plant
Superior Oil Corp., Elsie	3,000	.....	S	
Sweet Oil Ref. Co., Wyman	2,000	1,000	S	
Total	47,200			

*Under construction.

MISSOURI

Joplin Ref. Co., Joplin	1,500	.....	C	Jenkins
Standard Oil Co. (Ind.), Sugar Creek	16,500	.....	C-A	Burton, Holmes-Manley
Total	18,000			

MONTANA

Arro Oil & Ref. Co., Lewistown	2,000	.....	C	Dubbs
B & M Refining Co., Roundup	300	.....	S	
Big West Oil Co., Kevin	1,000	400	C	Dubbs
Conrad Ref. Co., Conrad	1,000	.....	S	
Consumers Ref. Co., Collins	500	.....	S	
Continental Oil Co., Lewistown	1,500	1,467	S	
Cut Bank Ref. Co., Cut Bank	350	100	S	
Dunlap Ref., Cat Creek	75	.....	S	
Fern Oil Co., Thermopolis	5,000	.....	Comp.	
Hart Refineries, Hedgesville	100	.....	S	
Hart Refineries, Missoula	300	.....	S	
Hole Bros. Ref., Cut Bank	250	.....	S	

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MONTANA (Continued)

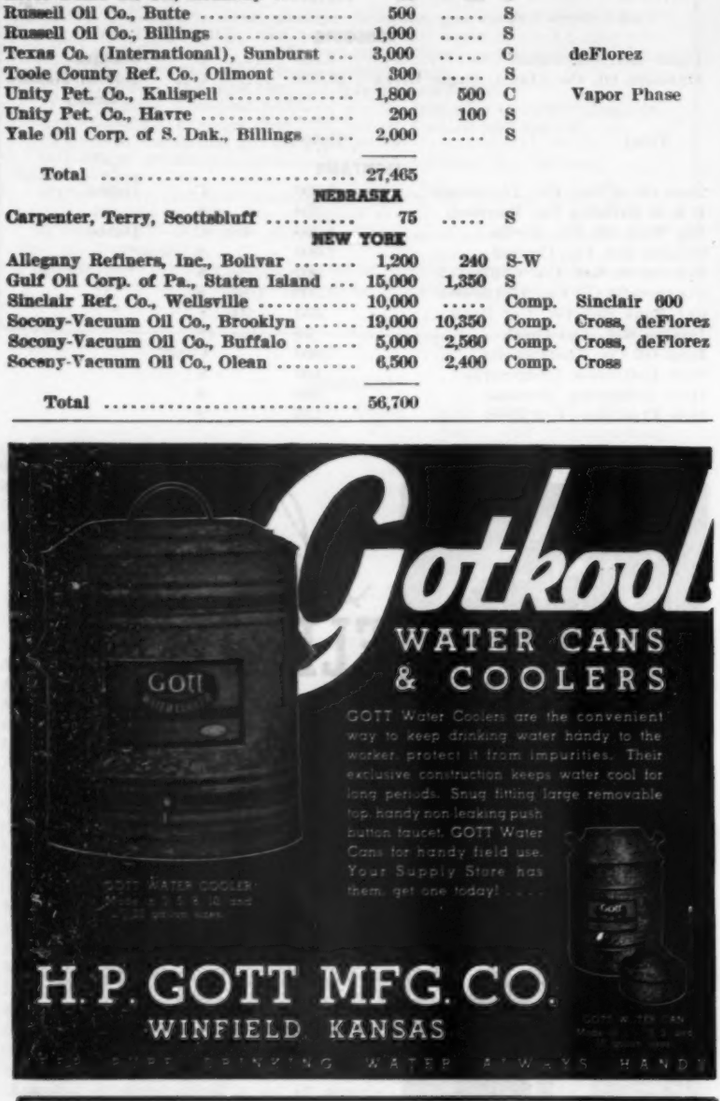
Company and plant location—	Crude oil cap.	Gasoline cap.	Type of refinery	Type of cracking plant
Home Oil & Ref. Co., Great Falls	1,000	500	C	Dubbs
Hunt, Eugene, Ref., Winnett	200	.....	S	
Independent Ref. Co., Laurel	5,000	1,000	C-A	Donnelly
Minntana Oil Co., Molt	30	.....	S	
River Dome Oil Co., Roundup	60	30	S	
Russell Oil Co., Butte	500	.....	S	
Russell Oil Co., Billings	1,000	.....	S	
Texas Co. (International), Sunburst	3,000	.....	C	deFlorez
Toole County Ref. Co., Oilmont	300	.....	S	
Unity Pet. Co., Kalispell	1,800	500	C	Vapor Phase
Unity Pet. Co., Havre	200	100	S	
Yale Oil Corp. of S. Dak., Billings	2,000	.....	S	
Total	27,465			

NEBRASKA

Carpenter, Terry, Scottsbluff	75	.....	S	

NEW YORK

Allegany Refiners, Inc., Bolivar	1,200	240	S-W	
Gulf Oil Corp. of Pa., Staten Island	15,000	1,350	S	
Sinclair Ref. Co., Wellsville	10,000	.....	Comp.	Sinclair 600
Socony-Vacuum Oil Co., Brooklyn	19,000	10,350	Comp.	Cross, deFlorez
Socony-Vacuum Oil Co., Buffalo	5,000	2,560	Comp.	Cross, deFlorez
Socony-Vacuum Oil Co., Olean	6,500	2,400	Comp.	Cross
Total	56,700			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TULSA, OKLAHOMA

NEW JERSEY

Company and plant location—	Crude oil cap.	Gasoline cap.	Type of refinery	Type of cracking plant
Barber Asphalt Co., Maurer*	10,000	2,000	C-A	Cross
Crew Levick Co., Petty Island	10,000	6,000	C	Doherty
Standard Oil Co. of N. J., Bayonne	70,000	.....	Comp.	Tube and Tank
Standard Oil Co. of N. J., Linden	70,000	42,250	Comp.	Tube and Tank
Standard Oil Co. of N. J., Jersey City	15,000	3,750	L-W	
Tide Water Oil Co., Bayonne	50,000	25,000	Comp.	Tube and Tank
Socony-Vacuum Oil Co., Paulsboro	20,000	5,640	Comp.	Cross, Ellis
Warner-Quinlan Oil Co., Warners	18,500	.....	S-A	
Total	263,500			

*Cracking plant operated by Bertrin Petroleum Co.

NEW MEXICO

Aerex Co., Bloomfield	100	4	S	
Basin Ref. Co., Aztec	100	.....	S	
Continental Oil Co., Farmington	1,000	864	S	
Continental Oil Co., Artesia	1,500	600	S	
Continental Oil Co., Albuquerque	1,000	818	S	
Malco Ref. Co., Artesia	2,000	.....	C	Dubbs
McNutt Oil & Ref. Co., Brickland	800	450	C	Donnelly
Pecos Diamond Ref. Co., Artesia	250	.....	S	
Valley Ref. Co., Roswell	300	200	S	
Total	7,050			

OHIO

Canfield Oil Co., Cleveland	1,000	.....	L	
Gulf Oil Corp. of Pa., Toledo	13,000	9,000	C	Gulf
Gulf Oil Corp. of Pa., Cincinnati	13,000	9,000	C-A	Gulf
Johnson, A. L., Ref., Wayne	45	.....	S	
National Ref. Co., Findlay	3,200	1,500	Comp.	National
National Ref. Co., Marietta	700	115	L-W	
Peninsula Oil Co., Catawba Island	50	20	S	
Pure Oil Co., Heath	10,000	5,500	C	Gyro, Cross
Pure Oil Co., Toledo	15,000	8,000	C	Gyro
Standard Oil Co. of Ohio, Cleveland	24,000	14,000	Comp.	Tube and Tank
Standard Oil Co. of Ohio, Toledo	12,000	6,500	Comp.	Tube and Tank
Standard Oil Co. of Ohio, Lima	7,500	5,000	C	Solar
Sun Oil Co., Toledo	14,000	.....	C	Sun
Wayco Ref. Co., Toledo	250	.....	L	
Total	113,745			

OKLAHOMA

Anderson-Prichard Oil Corp., Cyril	6,000	2,300	C-A	Winkler-Koch
Barnsdall Refs., Inc., Okmulgee	11,000	5,000	C	Cross
Barnsdall Refs., Inc., Barnsdall	5,000	3,000	C-L-W	Cross
Bell Oil & Gas Co., Grandfield	4,500	3,000	C-L	Dubbs
Black Gold Ref. Co., Oklahoma City	2,500	.....	C-L	Dubbs
Century Pet. Co., Oklahoma City	2,500	.....	S	
Champlin Ref. Co., Enid	15,000	.....	C-L-W	Cross, Winkler-Koch
Cole, L. S., Ref. Co., Oklahoma City	500	.....	S	
Columbus Ref. Co., Oklahoma City	2,500	.....	S	
Continental Oil Co., Ponca City	30,000	18,732	Comp.	Dubbs, Cross
Cushing Ref. & Gaso. Co., Cushing	4,500	3,390	C	Dubbs
Cushing Ref. & Gaso. Co., Blackwell	1,700	.....	S	
Deep Rock Oil Corp., Cushing	10,000	5,500	Comp.	Dubbs
Eason Oil Co., Enid	5,000	1,834	C-L	Jenkins
Empire Oil & Ref. Co., Okmulgee	4,000	.....	Comp.	Doherty
Empire Oil & Ref. Co., Ponca City	12,000	.....	Comp.	Dubbs, Doherty
Firestone Ref. Co., Oklahoma City	2,000	.....	S	
Globe Oil & Ref. Co., Blackwell	8,000	4,700	C	Winkler-Koch
Government Ref. Co. No. 2, Oklahoma City	3,500	.....	S	
Hanger Ref. Co., Oklahoma City	1,000	.....	S	
Johnson Oil Ref. Co., Cleveland	6,000	.....	C	Dubbs
Knox Ref. Co., Covington	250	20	S	
Major Petroleum Products Co., Oklahoma City	1,500	.....	S	
Marathon Oil Co., Bristow	5,000	2,200	C	Kellogg
Mid-Continent Pet. Corp., Tulsa	40,000	17,500	Comp.	Mid-Continent
Monarch Ref. Co., Oklahoma City	2,000	350	S	
Oklahoma City Ref. Co., Oklahoma City	2,500	.....	S	
Omar Ref. Co., Garber	5,000	3,000	C	Own
Phillips Pet. Co., Okmulgee	6,000	.....	C-L	Dubbs
Pilgrim, Inc., Ardmore	70	.....	L	
Pure Oil Co., Muskogee	9,000	5,000	Comp.	Cross, Gyro
Rock Island Ref. Co., Beckett	6,500	4,040	C	Winkler-Koch
Sinclair Ref. Co., Sand Springs	8,000	.....	Comp.	Cross
Sooner State Ref. Co., Oklahoma City	700	.....	S	
Sun Oil Co., Yale	5,000	.....	S	
Sunray Oil Co., Allen	6,000	2,000	C-A	Dubbs
Texas Co., West Tulsa	14,000	.....	Comp.	Holmes-Manley
Tide Water Oil Co. of Okla., Drumright	15,000	10,000	C	Tube and Tank
Triangle Prod. & Ref. Co., Oklahoma City	1,600	550	S	
Western Oil Corp., Beckett	2,000	1,200	C	Jenkins
Wilcox, H. F., Oil & Gas Co., Bristow	6,000	3,500	C	Dubbs
Total	273,320			

PENNSYLVANIA

Company and plant location—	Crude oil cap.	Gasoline cap.	Type of refinery	Type of cracking plant
Atlantic Ref. Co., Philadelphia	70,000	37,500	Comp.	Lewis, Cross, deFlorez Kellogg
Atlantic Ref. Co., Franklin	9,000	4,500	Comp.	Cross
James B. Berry Sons Co., Inc., Oil City	2,500	.....	S-L	
Bradford Oil Ref. Co., Bradford	2,000	420	S-L-W	
Bradford Penn Ref. Corp., Clarendon	1,000	600	L-W	
Canfield Oil Co., Coraopolis	1,500	.....	L	
Conewango Ref. Co., Warren	2,000	.....	L	
Continental Ref. Co., Oil City	1,000	*2,500	Comp.	Dubbs
Crew-Levick Co., Titusville	3,000	1,000	L-W	
Crystal Oil Works, Rouseville	1,000	.....	L-W	
Daugherty, W. H., & Son Ref. Co., Petrolia	4,000	1,200	L	
Franklin Creek Ref. Co., Franklin	1,500	400	L	
Freedom Oil Works Co., Freedom	2,500	1,100	L-W	Dubbs
Gulf Oil Corp. of Pa., Philadelphia	30,000	9,000	C-L	Gulf
Gulf Oil Corp. of Pa., Pittsburgh	10,000	5,600	C	Gulf
Kendall Ref. Co., Bradford	4,000	2,500	Comp.	Dubbs
Miller, A. D., Sons Co., Pittsburgh	1,000	.....	L	
Oil Creek Refining Co., East Titusville	1,600	600	L-W	
Pennsylvania Oil Products Co., Eldred	5,000	1,750	S-C-L	Conerty
Pennsylvania Ref. Co., Karns City	2,000	600	L-W	
Pennsylvania Ref. Co., Titusville	1,500	500	L	
Pennzoil Co., The, Oil City	8,000	4,500	L	Dubbs
Pure Oil Co., Marcus Hook	16,000	8,000	Comp.	Gyro, Cross
Quaker State Oil Ref. Corp., Farmers Valley	2,500	1,400	Comp.	Dubbs
Quaker State Oil Ref. Corp., Emlenton	2,000	1,000	Comp.	Dubbs
Sherwood Ref. Co., Warren	800	.....	W	
Sinclair Ref. Co., Marcus Hook	28,000	.....	C	Sinclair 600
Sloan & Zook Ref. Co., Warren	1,500	600	L-W	
Superior Oil Works, Warren	500	150	L-W	
Starlight Ref. Co., Karns City	600	250	L	
Sun Oil Co., Marcus Hook	63,000	.....	Comp.	Sun
Ultra-Penn Ref. Co., Bruin	1,000	100	Comp.	
United Ref. Co., Warren	3,000	1,650	Comp.	Dubbs
Valvoline Oil Co., Butler	3,000	800	Comp.	
Valvoline Oil Co., Franklin	.....	.....	Grease	
Warr-Pen Ref. Co., Warren	1,200	.....	S-L	
Waverly Oil Works Co., Pittsburgh	1,200	360	Comp.	Cross
Wolverine-Empire Ref. Co., Reno	2,500	1,400	Comp.	
Total	290,900			

*Cracking plant owned jointly by Pennzoil Co., James B. Berry Sons Co., Inc., Wolverine, Empire Refining Co. and Continental Refining Co.

RHODE ISLAND

Socony-Vacuum Oil Co., Inc., Providence	9,000	3,100	A-C	Cross
Texas Co., Providence	2,000	.....	A	
Total	11,000			

SOUTH CAROLINA

Standard Oil Co. of N. J., Charleston	6,500	.....	A	

SOUTH DAKOTA

Rex Oil Ref., Inc., Rapid City	100	15	S	

TEXAS

Acme Ref. Co., Gladewater	700	.....	S	
Adams Ref. Co., Big Spring	1,000	.....	S	
Admiral Ref. Co., Kilgore	2,500	.....	S	
Aero Ref. Co., Pecos	225	.....	S	
American Pet. Co., Houston	5,000	.....	S	
Amsco Ref. Co., Mirando City	4,000	1,000	C-L	Own
Arpana Ref. Co., Arp	4,000	.....	S	
Baird Ref. Co., Baird	1,400	.....	C	Dayson
Beacon Oil & Ref. Co., Henderson	4,500	.....	S	
Bennett Ref. Co., Houston	2,500	.....	S	
Bluebonnet Oil Ref. Co., Wickett	2,000	800	S	
Blue Diamond Ref. Co., Gladewater	1,500	.....	S	
Bradley Ref. Co., Kilgore	1,200	.....	S	
Canyon Oil & Gas Co., Inc., Cisco	600	.....	S	
Cascade Ref. Co., Reeds Switch	3,000	.....	S	
Central Ref. Co., Gladewater	2,000	.....	S	
Century Ref. Co., Friars Switch	2,300	.....	S	
Chapa Ref. Co., Laredo	100	.....	S	
Chief Refining, Inc.	2,000	740	T	
Coltex Ref. Co., Colorado	12,500	4,500	C-A	Richmond
Concho Ref. Co., San Angelo	200	.....	S	
Conroe Oil & Ref. Co., Conroe	250	.....	S	
Continental Oil Co., Wichita Falls	5,000	3,656	C	Cross
Corpus Christi Ref. Co., Corpus Christi	4,000	.....	C	Own
Cosden Oil Co., Big Spring	12,000	4,000	C-A	Donnelly
Crown Central Pet. Corp., Houston	10,000	.....	C-L	Holmes-Manley
Danciger Refineries, Inc., Pampa	7,000	.....	C	Bidison-Boyd
Deepwater Oil Refineries, Inc.	3,000	1,500	L	
Dominant Ref. Co., Kilgore	2,000	.....	S	
Dominant Ref. Co., Kilgore	4,000	.....	S	
East Texas Cracking Co., Camp Switch	4,200	.....	S	

TEXAS (Continued)

Company and plant location—	Crude oil cap.	Gasoline cap.	Type of refinery	Type of cracking plant
East Texas Ref. Co., Longview	10,000	.....	S-C	Donnelly
Exchange Pet. Co., Albany	800	250	S	
Falls Refining Co., Wichita Falls	2,500	.....	S	
Gibson Ref. Corp., Magic City	250	.....	S	
Gilliland Ref. Co., Gladewater	3,500	.....	S-C	Own
Gilliland Ref. Co., Overton	5,500	.....	C-S	
Godlin Ref. Co., Gladewater	850	.....	S	
Goldman Ref. Co., Gladewater	1,100	.....	S	
Gratex Ref. Co., Graham	300	120	S	
Gulf Oil Corp. of Pa., Port Arthur	100,000	40,000	Comp.	Gulf
Gulf Oil Corp. of Pa., Fort Worth	6,000	3,300	C	Gulf
Gulf Oil Corp. of Pa., Sweetwater	5,000	2,500	C	Gulf
Haskell Oil Ref. Corp., Breckenridge	200	.....	S	
Holmes Ref. Co., Gladewater	1,500	.....	S	
Houston Oil Co. of Texas, Corpus Christi	1,000	275	T	
Howard County Ref. Co., Big Spring	1,500	.....	S	
Hub Ref. Co., Reed's Switch	100	.....	S	
Humble Oil & Ref. Co., Ingleside	15,000	5,000	C	Tube and Tank
Humble Oil & Ref. Co., Baytown	115,000	47,500	Comp.	Cross, Tube & Tank
Humble Oil & Ref. Co., San Antonio	4,500	900	S	
Humble Oil & Ref. Co., Neches	5,000	1,700	S	
Hurricane Pet. Corp., Overton	4,500	2,925	C	Own
Jacksboro Ref. Co., Jacksboro	50	.....	S	
Jackson Ref. Co., Gladewater	1,500	.....	S	
M. S. Johnson Ref. Co., Gladewater	1,250	.....	S	
Johnson Ref. Co., Kilgore	1,000	.....	S	
Keystone Ref. Co., Gladewater	1,000	.....	S	
Lake Ref. Co., Gladewater	2,500	925	S	
La Petite Ref. Co., Joinerville	800	.....	S	
La Pren Ref. Co., Kilgore	2,000	.....	S	
LaSalle Pet. Co., Burkburnett	3,000	275	S	
Magnolia Pet. Co., Beaumont	80,000	34,000	Comp.	Cross
Magnolia Pet. Co., Fort Worth	7,000	3,000	C	Cross
Magnolia Pet. Co., Corsicana	4,000	1,200	S	
Magnolia Pet. Co., Luling	6,000	2,800	C	Controlled Coil
Marathon Oil Co., Fort Worth	5,000	2,400	C-L-W	Kellogg
Master Pet. Co., Waco	1,000	.....	S	
Matthews Ref. Co., Gladewater	1,000	.....	S	
McKain Fuel Oil Co., Gladewater	800	.....	S	
McMurray Ref. Co., Arp	4,000	.....	S-C	Own
McNutt Ref. Co., El Paso	2,000	.....	S	
Mentone Oil & Ref. Co., Arno	1,000	.....	S	
Midway Oil & Ref. Co., Pettus	1,800	400	S	
Minerva Ref. Co., Minerva	2,000	.....	S	
Moutray Oil Co., Hawley	600	200	S	
Muenster Ref. Co., Muenster	300	.....	S	
Nolting Ref. Co., Sweetwater	1,000	.....	S	
Olney Oil & Ref. Co., Olney	3,000	1,550	C	Donnelly
Omega Ref. Co., Brownwood	130	.....	S	
Onyx Ref. Co., Abilene	800	.....	S	
Oriental Oil Co., Dallas	1,500	1,500	S-C	Floyd
Overton Ref. Co., Overton	3,000	750	S-C	Overton
Ozozo Ref. Co., Friars Switch	10,000	.....	S	
Panama Ref. Co., Kilgore	3,000	.....	S	
Pan American Pet. & Trans. Co., Texas City	50,000	.....	C	Combination
Panhandle Ref. Co., Wichita Falls	3,400	1,650	C	Dubbs
Panhandle Ref. Co., Kings Mill	2,000	750	S	
Panhandle Ref. Co., Leuders	600	200	S	
Pennant Ref. Co., Kilgore	1,300	.....	S	
Pettus Oil & Ref. Co., Mathis	1,200	400	S	
Pettus Oil & Ref. Co., Pettus	1,200	450	S	
Phillips Pet. Co., Borger	50,000	.....	C-A	Phillips
Phoenix Ref. Co., Bruni	600	.....	S	
Phoenix Ref. Co., San Antonio	500	.....	S	
Pilot Point Ref. Co., Pilot Point	500	.....	S	
Pioneer Oil & Ref. Co., Somerset	2,000	750	L	
Plainview Ref. Co., Plainview	1,000	1,000	.....	S
Premier Ref. Co., Longview	4,000	2,000	T	
Price Ref. Co., San Antonio	500	.....	S	
Primrose Ref. Co., Wichita Falls	2,500	.....	S	
Pure Oil Co., Smiths Bluff (Nederland)	30,000	14,000	C	Gyro
Rado Ref. & Prod. Co., McAllen	300	100	L	
Recla Ref. Co., Turnerstown	200	.....	S	
Republic Oil & Ref. Co., Texas City	5,000	3,500	C	Winkler-Koch
Sabine Ref. Co., Gladewater	200	.....	S	
San Angelo Ref. Co., San Angelo	2,000	.....	S	
Security Pet. Co., Chase	3,100	.....	S	
Shamrock Oil & Gas Co., Meldavis	1,600	600	S	
Shamrock Oil & Gas Co., Sunray	2,000	400	S	
Shell Pet. Corp., Houston	56,000	19,500	C	Dubbs
Shoreline Ref. Co., Kilgore	2,700	.....	S	
Sinclair Ref. Co., Gladewater	2,500	.....	S	
Sinclair Ref. Co., Houston	44,000	.....	Comp.	Sinclair 600
Sinclair Ref. Co., Fort Worth	4,000	.....	C	Sinclair 600
Solvex Refineries, Inc., Gladewater	6,000	4,200	C	Dubbs
Southern Ref. Co., Overton	3,000	.....	S	
Southland Ref. Co., Megargel	500	.....	S	

TEXAS (Continued)

Company and plant location—	Crude oil cap.	Gasoline cap.	Type of refinery	Type of cracking plant
Southport Ref. Co., Kilgore	3,300	.....	S-C	Own
Stag Ref. Co., Kilgore	1,200	.....	S	
Standard Oil Co. of Texas, El Paso	14,000	6,000	C	Dubbs
Star Ref. & Prod. Co., Fort Worth	1,200	600	C	Donnelly
Stone Oil Co., Texas City	7,500	2,500	C	Jenkins
Superior Ref. Co., Tiffin	800	.....	S	
Supreme Ref. Co., Gladewater	1,000	.....	S	
Taylor Ref. Co., Taylor	4,000	.....	C	Own
Texas Co., Port Arthur	80,000	.....	Comp.	Holmes-Manley, deFlorez, Pressure Coke
Texas Co., West Dallas	16,000	.....	C	Holmes-Manley, deFlorez Pressure Coke
Texas Co., Amarillo	4,000	.....	C	Pressure Coke, deFlorez
Texas Co., Port Neches	22,000	.....	A	
Texas Co., Houston	20,000	.....	C	Tube and Tank
Texas Co., San Antonio	4,500	.....	C	Holmes-Manley
Texas Co., El Paso	1,800	.....	C	Holmes-Manley
Texas Oil Products Co., Gladewater	4,000	.....	S-C	Own
Texas Pacific Coal & Oil Co., Caddo	600	240	S	
Texas Pet. Products Co., Somerset	2,000	.....	S	
Trico Ref. Co., Turnerstown	200	.....	S	
Trio Ref. Co., Arp	1,500	1,020	S-C	Own
Trinity Ref. Co., Gladewater	6,000	.....	C	Lummus
Tucker Oil Co., Burkburnett	250	125	S	
Tyler Ref. Co., Arp	2,000	.....	S	
Tyler Texas Oil & Ref. Co., Tyler	15,000	.....	S-C	Own
Tyreco Ref. Co., Arp	3,000	.....	S	
Tyreco Ref. Co., Overton	2,500	.....	S	
Union Ref. Co., Camp Switch	3,000	.....	S	
Unit Ref. Co., Kilgore	200	.....	S	
Upshur Ref. Co., Gladewater	750	.....	S	
Utah Ref. Co., Kilgore	2,500	.....	S	
Valley Ref. Co., Harlingen	1,000	350	S	
Waggoner Ref. Co., Inc., Electra	4,500	1,540	S	
White Star Ref. Co., Cisco	500	.....	S	
Wichita Ref. Co., Gladewater	500	.....	S	
Wickett Ref. Co., Wickett	2,500	900	S	
Wood-Moore Corp., Port Lavaca	1,500	800	S-L	
Total	1,052,995			

UTAH

Jenson Oil Ref. Co.	1,000	.....	C-L	Own
Utah Oil Ref. Co., Salt Lake City	6,000	4,355	Comp.	Modified Holmes-Manley
Wasatch Oil Ref. Co., Woods Cross	1,400	.....	C	Vapor Phase
Total	8,400			

VIRGINIA

Texas Co., Norfolk	2,000	.....	A	

WEST VIRGINIA

Carbide & Carbon Chemicals Corp., South Charleston	2,000	1,000	C	Gyro
Elk Ref. Co., Falling Rock	2,500	.....	L-W	
Ohio Valley Ref. Co., St. Marys	2,000	1,000	Comp.	Dubbs
Pure Oil Co., Cabin Creek	3,500	2,100	Comp.	Gyro
Standard Oil Co. of N. J., Parkersburg	6,000	3,525	L-A	Tube and Tank
Total	16,000			

WYOMING

C. & H. Refinery, Lusk	100	20	S	
Continental Oil Co., Glenrock	2,500	1,874	C	Cross
Eclipse Oil & Ref. Co., New Castle	250	.....	S	
Egaso Operating Co., Osage	750	.....	S-C	Cross
Goshen Oil Ref. Co., Torrington	250	.....	S	
Gillette Ref. Co., Gillette	250	.....	S	
Gillette Ref. Co., New Castle	100	.....	S	
Gillette Ref. Co., Sheridan	250	.....	S	
Midland Oil Ref. Co., Osage	300	.....	S	
Northwestern Pet. Co., Osage	300	.....	S	
Oreana Ref. Co., LaBarge	100	.....	S	
Pedro Ref. Co., New Castle	500	.....	L	
Sinclair Ref. Co., Parco	8,000	.....	C	Dubbs
Socony-Vacuum Oil Co., Inc., White Eagle Division	5,000	2,800	Comp.	White Eagle
Standard Oil Co. (Ind.), Casper	12,600	.....	Comp.	Vapor Phase, Kellogg
Standard Oil Co. (Ind.), Greybull	5,000	.....	C-A	Cross
Star Refinery, Osage	75	.....	S	
Texas Co., Casper	7,000	.....	C	Holmes-Manley,
Texas Co., Cody	3,000	.....	C	Holmes-Manley
Texas Co., Calpet	300	.....	S	
Wheatland Ref. Co., Wheatland	75	.....	S	
Wyoming Gas & Oil Co., Osage	150	.....	S	
Total	46,850			

Shut-Down Refineries in the United States

The following tables list the shut-down refineries in the United States. The following abbreviations are used: S—skimming; C—cracking; L—lubricating oils; A—asphalt.

ALABAMA

Company and plant location—	Crude oil cap.	Gasoline cap.	Type of refinery	Type of cracking plant
Coastal Pet. Corp., Mobile	6,000	.....	C	Coastal

ARIZONA

Rio Grande Oil Co., Phoenix	1,000	.....	S	

ARKANSAS

E. M. Tulle Ref., El Dorado	1,000	.....	S	
Houston Oil Co., Camden	3,500	.....	C	Dubbs
Ouachita Valley Ref. Co., El Dorado	2,000	.....	C	Dubbs
Stephens Ref. Co., Stephens	750	.....	S	
Simms Oil Co., Smackover	3,000	.....	C	Cross
Union Asphalt Co., El Dorado	2,000	.....	C	Union
Total	12,250			

CALIFORNIA

American Oil & Ref. Co., Hynes	2,500	.....	S	
East West Ref. Co., Los Angeles	1,000	.....	S	
General Petroleum Corp., Olinda	2,000	.....	S	
Hart Dearing Ref. Co., Fellows	2,500	.....	S	
Hercules Gasoline Co., Los Angeles	5,500	.....	C-A	Jenkins
McCallen, M. M., Ref. & Prod. Co., Huntington Beach	1,200	.....	A	
Orange County Ref. Co., Newport	1,000	.....	S	
Richfield Oil Co., Los Angeles	4,000	.....	S	
Richfield Oil Co., Bakersfield	2,000	.....	S	
Seaside Oil Co., Summerland	500	150	A	
Signal Oil Co., Hynes	5,000	.....	T	
Standard Gasoline Co., Taft	1,500	500	S	
Texas Co. (Calif.), Coalinga	500	.....	T	
Union Oil Co. of Calif., Avila	10,000	.....	S	
Wilshire Oil Co., Fellows	2,500	.....	S	
Total	47,100			

COLORADO

Denver Ref. Syndicate, Denver	500	.....	S	
Mancos Dome Ref. Co., Mancos Creek	60	.....	S	
Total	560			

ILLINOIS

Barber Asphalt Co., Madison	700	.....	A	
Interocean Ref. Co., McCook	5,000	.....	L	
Socony-Vacuum Oil Co., Inc., (Lubrite), Wood River	5,500	.....	C	Dubbs
Total	11,200			

INDIANA

Interstate Gasoline Co., East Chicago	2,500	.....	S	
Portland Oil & Ref. Co., Portland	600	.....	S	
Total	3,100			

IOWA

MonaMotor Oil Co., Council Bluffs	1,500	.....	S	

KANSAS

Grant Oil Co., Augusta	2,500	.....	S	
Richardson Ref. Co., Eldorado	1,500	.....	S	
Total	4,000			

KENTUCKY

Central Prod. & Ref. Co., Bowling Green	600	.....	S	
Great Southern Ref. Co., Lexington	2,500	.....	L	
Neha Ref. Co., Lexington	800	.....	S	
Standard Oil Co. of Ky., Louisville	5,000	.....	C	Burton
Total	8,900			

LOUISIANA

Great Southern Ref. Co., Ardis	2,000	.....	S	
Gupeco Ref. Co., Inc., Alexandria	600	.....	S	
Louisiana Oil Ref. Co., Shreveport	15,000	.....	S	
Red River Ref. Co., Crichton	1,800	.....	S	
Shreveport Ref. Co., Shreveport	500	.....	S	
Total	19,900			

MARYLAND

Interocean Oil Co., Baltimore	7,000	.....	C	Leamon

MISSISSIPPI

Dixie Oil & Ref. Co., Jackson	1,500	.....	S	

MONTANA

Company and plant location—	Crude oil cap.	Gasoline cap.	Type of refinery	Type of cracking plant
American Ref. Co., Great Falls	1,000	.....	S	
Laurel Oil & Ref. Co., Laurel	5,000	.....	C	Laurel
Montana Ref. Co., Billings	750	.....	S	
Northwest Stellarine Co., Inc., Shelby	1,500	.....	S	
Round Up Oil & Ref. Co., Butte	200	.....	S	
Snow Cap Oil Co., Sunburst	330	.....	C	Own
Yale Oil Corp., Miles City	800	.....	S	
Total	9,580			

NEW JERSEY

Middlesex Ref. Co., New Brunswick	5,000	2,000	T	

NEW MEXICO

Bloomfield Oil & Gas Co., Bloomfield	300	.....	S	
State Oil & Ref. Co., Dayton	2,500	.....	S	
Sullivan Refs., Inc., Dayton	1,500	.....	S	
Total	4,300			

OHIO

Allegheny-Arrow Oil Co., Canton	1,500	.....	C	Dubbs
Craig Oil Co., Toledo	1,500	.....	L	
Rajah Oil & Ref. Co., Youngstown	500	.....	S	
Total	3,500			

OKLAHOMA

Associated Petroleum Co., Allen	8,000	.....	C	Jenkins
Canfield Oil Co., Yale	400	.....	L	
Carter Oil Co., Cartoco	5,000	.....	S	
Century Pet. Co., Tulsa	2,000	.....	S	
Crescent Ref. Co., Holdenville	1,000	.....	S	
Empire Oil & Ref. Co., Cushing	5,000	.....	S	
Gem Refining Co., Oklahoma City	1,000	.....	S	
Gilmer Oil Co., Ringling	1,000	.....	S	
Government Ref. Co., Oklahoma City	4,500	.....	S	
Government Ref. Co., Seminole	800	.....	S	
Huckins Ref. Co., Earlsboro	500	.....	S	
Illinois Oil Co., Cushing	3,000	.....	C	Donnelly
Imperial Ref. Co., Ardmore	4,000	.....	C	
Interocean Oil Co., Bristow	3,000	.....	S	
Morgan Pet. Co., Tonkawa	3,000	.....	S	
Peppers Gasoline Co., Covington	1,000	.....	S	
Santa Fe Oil & Ref. Co., Ardmore	5,000	.....	S	
Sinclair Ref. Co., West Tulsa	6,000	.....	C	Dubbs
Superior Oil Corp., Grandfield	2,000	.....	S	
Walters Ref. Co., Walters	2,500	.....	S	
Wirt Franklin Pet. Corp., Ardmore	4,000	828	S	
Yale Oil Corp., Yale	2,000	600	S	
York Ref. Co., Oklahoma City	2,000	.....	S	
Total	66,700			

PENNSYLVANIA

Atlantic Ref. Co., Pittsburgh	8,000	4,000	Comp.	Cross
Conewango Ref. Co., Langdale Switch	2,000	.....	S	
Island Pet. Co., Neville Island	1,000	.....	L	
North Penn Ref. Co., Tiona	500	.....	L	
Pure-Penn Ref. Co., Clarendon	350	.....	L	
Tiona Ref. Co., Clarendon	1,000	400	L-W	
Titusville Oil Works, Titusville	1,000	.....	L-C	Titusville
Valvoline Oil Co., Warren	1,000	.....	Comp.	
Viking Oil Corp., Clarendon	2,000	.....	L	
Waverly Oil Works, Coraopolis	4,000	.....	C	Cross
Wolverine-Empire Ref. Co., Tidioute	800	.....	S	
Total	21,650			

TENNESSEE

Nashville Oil Co., Nashville	500	.....	S	
Urania Pet. Co., Ltd., Memphis	500	.....	S	
Total	1,000			

TEXAS

Active Oil Corp., Arno	1,500	.....	S	
Allstate Ref. Co., Thrall	2,500	750	S	
American Ref. Properties, Wichita Falls	5,000	.....	C	Dubbs
Arktex Ref. Co., Kilgore	1,000	.....	S	
Artex Ref. Co. No. 1, Arp	1,600	.....	S	
Artex Ref. Co., No. 2, Longview	3,700	.....	S	
Atlas Ref. Co., Gladewater	100	.....	S	
Aviation Ref. Co., Kilgore	200	.....	S	
Bartlett Ref. Co. Kilgore	200	.....	S	
Capitol Ref. Co., Luling	2,500	.....	S	
Central Ref. Co., Friars Switch	10,000	.....	S	

TEXAS (Continued)

Company and plant location—	Crude oil cap.	Gasoline cap.	Type of refinery	Type of cracking plant
Citizens Oil & Ref. Corp., Luling	500	300	S	
Crystal Oil Corp., Burkburnett	1,000	.....	S	
Danciger Oil & Refineries, Inc., Bodie	10,000	.....	S	
East Texas Ref. Co., Henderson	6,000	.....	S	
Empire Oil & Ref. Co., Gainesville	5,000	.....	C	Dubbs
Ewno Oil Corp., Luling	2,500	.....	S	
Foster & Co., Dennison	600	.....	S	
Four States Ref. Co., Texarkana	700	.....	S	
Freeport Asphalt Co., Freeport	5,000	.....	S-A	
Friars Topping Co., Friars Switch	1,500	.....	S	
Gilmer Ref. Co., Gilmer	700	200	S	
Golden West Oil Co., Hondo	150	.....	S	
Goodson Bros. Ref. Co., Gladewater	1,000	.....	S	
Great West Ref. Co., Big Spring	5,000	.....	S	
Gregg Oil Products, Gladewater	500	.....	S	
Henderson Ref. Co., Henderson	12,000	.....	S	
Hill Ref. Co., Ballinger	45	.....	S	
Ideal Ref. Co., Gladewater	750	.....	S	
Iowa Park Prod. & Ref. Co., Iowa Park	3,000	.....	S	
Johnson Ref. Co., Kilgore	1,400	518	S	
Keystone Ref. Co., Gladewater	2,300	.....	S	
Kilgore Ref. Co., Kilgore	3,000	.....	C	Own
Kiltex Ref. Co., Kilgore	500	.....	S	
London Topping & Ref. Co., Overton	400	.....	S	
Macmillan Petroleum Corp., Borger	8,000	.....	S	
Magnolia Pet. Co., Magpetco	10,000	.....	S	
Master Ref. Co., Waco	1,000	.....	S	
Mid-Tex Ref. Co., Midland	2,500	.....	S	
Minerva Ref. Co., Minerva	2,000	.....	S	
Motor Fuels Products Co., Laredo	1,500	.....	C	Jenkins
Nacogdoches Ref., Inc., Nacogdoches	500	.....	L	
Norgold Ref. Co., Olney	1,000	.....	S	
Nueces Ref. Co., Banquette	1,000	.....	T	
Ocean Ref. Co., Kilgore	3,000	.....	S	
Outdoor Ref. Co., Kilgore	900	.....	S	
Panama Ref. Co., Kilgore	3,500	.....	S	
Paramount Refineries, San Angelo	2,000	.....	S	
Pennant Ref. Co., Kilgore	1,300	.....	S	
Pentex Ref. Co., Gladewater	500	.....	S	
Petroleum Conversion Corp., Texas City	300	.....	C	T.V.P.
Pope Ref. Co., Gladewater	1,700	.....	S	
Primrose Ref. Co., Wichita Falls	2,500	.....	S	
Producers Oil & Ref. Co., Kilgore	2,700	.....	S	
Richardson Ref. Co., Big Spring	7,500	.....	C	Jenkins
Rig Topping & Ref. Co., Kilgore	200	.....	S	
Roco Ref. Co., Kilgore	2,400	.....	S	
Rusk Oil & Ref. Co., Overton	4,000	1,480	S	
Samuel, J. Howard, Refinery, Coleman	100	.....	L	
Seymour Ref. Co., Seymour	250	.....	S	
Simms Oil Co., Dallas	4,000	3,200	C	Cross
Southern Oil Ref. Co., Reeds	3,000	.....	S	
Staley, J. I., Refinery, Reeds Switch	6,000	.....	S	
Superior Ref. Co., Tiffin	2,000	.....	S	
Sweetwater Oil & Ref. Co., Sweetwater	1,000	.....	S	
Taxman Ref. Co., Wichita Falls	3,500	1,100	C	Donnelly
Texas Mexican Oil & Ref. Co., Laredo	800	.....	S	
Texas State Ref. Co., Kilgore	1,000	.....	S	
Twintex Ref. Co., Kilgore	200	.....	S	
Upshur Ref. Co., Gladewater	1,000	.....	S	
Wabash Ref. Co., Gladewater	1,000	.....	S	
Western Oil Corp., Burkburnett	3,000	.....	S	
West Texas Ref. Co., Pecos	6,000	.....	C	Donnelly
Young Ref. Co., Archer City	250	.....	S	
Yuba Oil Co., Nacogdoches	200	.....	S	
Total	185,145			

UTAH

Diamond Oil Co., Virgin	200	.....	S	

WASHINGTON

Inland Empire Ref. Co., Parkwater	500	.....	S	
Spokane Oil & Ref. Co., Hillyard	1,000	.....	S	
Total	1,500			

WEST VIRGINIA

Tri-State Ref. Co., Kenova	2,500	1,350	C-A	Jenkins

WYOMING

Alliance Oil & Ref. Co., Thermopolis	1,500	.....	S	
Eclipse Oil & Ref. Co., Newcastle	40	.....	S	
Lovell Ref. Co., Lovell	600	.....	S	
Lusk Oil & Ref. Co., Lusk	44	.....	S	
Osage Ref. Co., Osage	1,000	1,000	C	Old Type Cross
Wyoil Ref. Co., Casper	300	.....	S	
Total	3,484			

Oklahoma Operations

By
DAL DALRYMPLE

DEEP TEST IN LOVE COUNTY ACTS LIKE DISCOVERY WELL

A deep Oklahoma wildcat that seemed doomed as a failure at the weekend, revived hopes of the operators Monday, and indications were that Love County was about to get its first oil pool. The Sinclair Prairie Oil Co. No. 1 Stockton, SE SE SW section 26-6-2w, in the Oswalt area of northern Love County, was bailed down Saturday and there was nothing showing but mud and water which drillers had dumped into the hole. The discouraging report went out that it was a duster.

The well had several oil showings, however, so the operators decided to do some more testing. It was thought the well had been bailed to bottom at 6,914 feet, but when steel line measurement was taken it was found to be some 40 feet off bottom. More bailing and washing followed, with the result that Monday fluid had risen 1,400 feet in the hole, and most of the fluid was oil, reviving expectations that the wildcat would open a new Oklahoma pool. It was still 24 feet off bottom with the oil in the hole, and the hole apparently had bridged over the sand. This may necessitate going in with the drill pipe and knocking out the bridge before a production test can be made. Oil is coming from a sand in the Deese series, at 6,892 to 6,914 feet. The original hole was drilled to 7,165 feet, and plugged back to around 5,700 feet and redrilled.

"Outlaw" in Capitol Area

The Oklahoma City sector continued to hold the oil spotlight, the latest furore being caused by the staking of an "outlaw" well on a tract of land about three blocks southwest of the state capitol. The location was staked by the K. & L. Petroleum Co., which moved suddenly Saturday into the restricted area in defiance of Oklahoma City zoning laws. Kent Shartel, company official, has asked the federal court to enjoin the city from preventing drilling for oil on the ground that the zoning ordinance is discriminatory. Operators were preparing to dynamite a hard soil stratum for a cellar Monday.

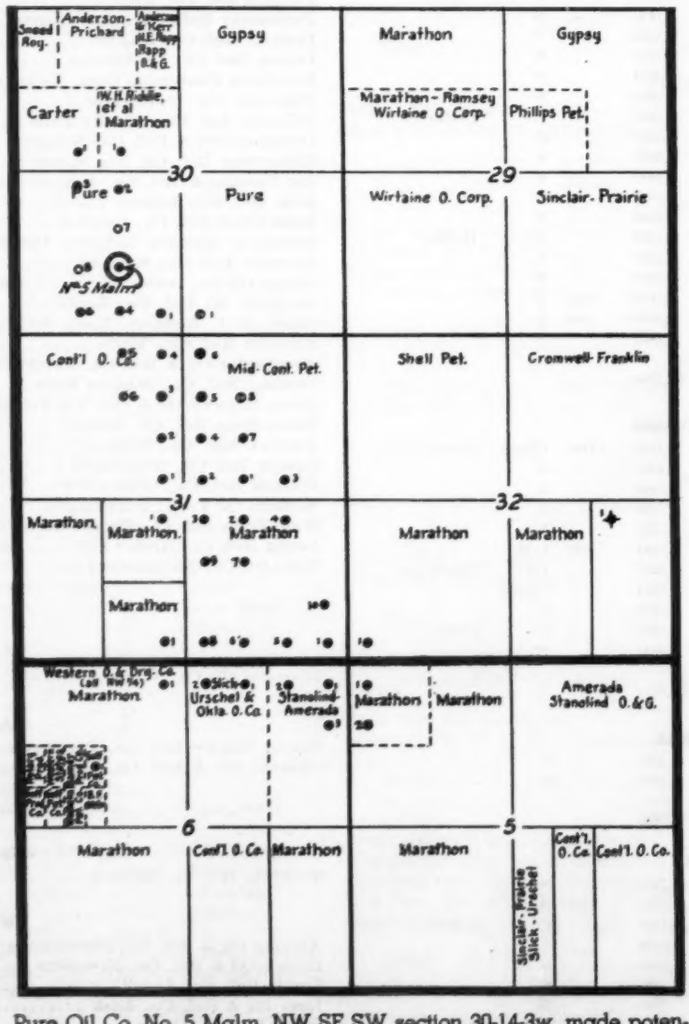
Phillips Petroleum Co. and Black Gold Petroleum Co. 1. Sawyer, SE NE NE section 22-12-3w, one-half mile north extension well in the capitol area of the city field, was preparing to take initial test, after flowing between 200 to 230 bbls. of oil an hour and producing 20,000,000 feet of gas daily, with drill pipe in the hole. Wilcox sand was topped at 6,389 feet; total depth, 6,460 feet. In the Edmond area, Pure Oil Co. was completing another well at the No. 6 Malm, SE SW SW section 30-14-3w. It flowed 379 bbls. of oil in four hours from 6,706 feet, total depth, gas gauging 17,500,000 feet. The No. 5 Malm previously had been completed, making potential of 5,556 bbls. of oil and rating as the biggest producer on the north side of the pool.

In the Jesse area of Pontotoc County, Continental Oil Co. No. 1 Simpson, SW SW NE section 12-1-7, flowed 1,057 bbls. of oil in two and one-half hours from pay at 4,650-62 feet. Operators were preparing to deepen with cable tools. It is the second Wilcox sand producer in the area, and is a southeast offset to the same company's discovery well.

Pontotoc County

Amerada Petroleum Corp. No. 3 Norris, SE SW SE section 26-2-6, on the west side of the Fitts pool of Pontotoc County, was completed with potential rating of 1,638 bbls. of oil, gas gauging 850,000 feet. Top of Bromide was 4,290 feet, total depth 4,455 feet. Acidized with 4,000 gallons, it flowed 507 bbls. of oil, gross, through tubing in 14 hours, and 87 bbls. of oil in six hours through casing; reacidized with 5,000 gallons, it flowed 790 bbls. of oil, gross, through casing in 14 hours.

Sinclair Prairie Oil Co. No. 1 Burris, SE NE NW section 27-2-7, topped Bromide at 4,105 feet, McLish 4,303 feet, total depth 4,305 feet, flowed 210 bbls. of oil the first hour through casing and 194 bbls. the next one and one-half hours through tubing; was acidized with 8,000 gallons, flowed 726 bbls. in five hours through tubing and made potential of 3,093 bbls. Same operators' No. 2 Burris, SW NW NW section 27-2-7, made potential of 2,940 bbls. of oil and was completed. Bromide was topped at 4,057 feet, McLish 4,284 feet, total depth 4,290 feet. It was acidized with 6,000 gallons, flowed 760 bbls. gross the first hour through casing, 322 bbls. net the next two hours through tubing and produced 2,952,000 feet of gas. The No. 3 Burris, SW NE NW section 27-2-7, topped Bromide at 4,160 feet, McLish 4,287 feet, total depth 4,295 feet. It was acidized with 6,000 gallons and made potential of 3,720 bbls.



Pure Oil Co. No. 5 Malm, NW SE SW section 30-14-3w, made potential of 5,556 bbls. of oil and is the biggest producer in north end of Edmond pool, Oklahoma County
(Mid-Continent Map Co., Tulsa, Okla.)

E. H. Moore and others No. 6 Harper, SE NW NE section 29-2-7, was completed after making potential of 3,580 bbls. of oil, gas gauging 5,014,000 feet. Bromide was topped at 4,122 feet, total depth 4,364 feet. It flowed 1,558 bbls. in two hours before taking potential test. Same operators' No. 13-A Schauers, NW cor. section 29-2-7, topped Bromide at 4,210 feet, total depth 4,320 feet, and made potential of 2,239 bbls. of oil after acidizing with 8,000 gallons.

Magnolia Petroleum Co. No. 2 Statler, NE SE SW section 28-2-7, made potential of 2,224 bbls. of oil and was completed. It topped Bromide at 3,835 feet, McLish 4,030 feet, total depth 4,300 feet, was acidized and flowed 456 bbls. in 3 hours and 10 minutes. Stahl Petroleum Co. No. 1-A Dennis, SW NE NW section 28-2-7, had sands at 1,581-91 feet and 1,601-31 feet, total depth 1,823 feet. Salt water intruded and it was plugged back to 1,635 feet, produced 12,500,000 feet of gas and was completed.

Carter Oil Co. No. 6 Richards, SE NW SE section 30-2-7, an old well deepened from 4,200 feet to 4,410 feet, made potential of 2,663 bbls. of oil, completed. Stanolind Oil & Gas Co. No. 5 Morris, NW SW SE section 25-2-6, an old well plugged back from 4,297 feet to 4,237 feet, perforated casing, acidized and flowed 289 bbls. in six hours through tubing, completed.

O. H. P. Thomas No. 5 Gilmore, C NW NW section 28-5-8, in the Allen area, topped sand at 797 feet, total depth 808 feet, pumped 25 bbls. of oil in 24 hours and was completed. Mid-Continent Petroleum Corp. No. 1 Milligan, SE NE NE section 25-5-4, old well deepened from 2,346 feet to 2,400 feet, pumped 80 bbls. of oil gross in 16 hours and 35 bbls. net in 24 hours, completed. W. A. Delaney No. 1 Constance, SE NE NE section 20-5-6, deepened from 1,875 feet to 2,760 feet and was dry and abandoned.

An old Pontotoc County wildcat that was deepened was completed as a small pumper. Pioneer Oil & Gas Co. No. 1 Bayne, SE SW SW section 16-5-6, deepened from 2,753 feet, had a hole full of water at 3,016 feet. It was plugged back to 3,006 feet, acidized without result, and plugged back again to 2,760 feet, where it pumped

7 bbls. of oil in 24 hours on completion test.

New work in Pontotoc County was as follows: Manahan Oil Co. and others No. 6 Reynolds-Wagner, NW NW SW section 17-2-7, rigging up; H. L. Blackstock and others No. 2 Daniels, NW SE SW section 21-2-7, building rig; Magnolia Petroleum Co. No. 1 King, SW SW SE section 21-2-7, location; same operator's No. 4 Burris "B," SE SE NE section 28-2-7, cellar and pits; same operator's No. 1 Woolley, NW NE NE section 28-2-7, location; J. E. Crosbie, Inc., No. 2-A Harden, SE NE NE section 30-2-7, location; Sandback and others No. 1 Sands, NE NE NE section 20-3-5, machine; J. L. Shaw No. 1 Illinois Bankers Life, NW SE NW section 14-5, rigging up rotary.

Magnolia Petroleum Co. No. 2 Metropolitan, NE NE SW section 27-2-7, had top of Bromide at 3,930 feet, total depth 4,275 feet, flowed 850 bbls. of oil in five hours and was treated with 5,000 gallons of acid. Same operator's No. 1 Shelton, SW SE SW section 28-2-7, faulted into Bromide at 3,900 feet, topped McLish at 4,070 feet, total depth 4,325 feet, flowed 302 bbls. of oil in 10 hours through casing and was acidized.

E. H. Moore and others' No. 6 Wirick, NE NE SW section 29-2-7, an old well deepening from 4,309 feet, drilled to 4,410 feet, total depth, and flowed 728 bbls. of oil the first hour and 835 bbls. the second hour. Same operators' No. 7 Wirick, NW NE SW section 29-2-7, topped Bromide at 3,965 feet, drilled to 3,983 feet, was treated with 6,000 gallons of acid, flowed 453 bbls. of oil, gross, the first hour and 131 bbls. the second hour. At 4,171 feet it flowed 298 bbls. of oil in one hour, gas gauging 6,500,000 feet. It was drilling ahead below 4,175 feet.

Seminole County

Francis Oil Co. No. 1 Huddleston, NE NW SW section 19-5-6, in the Byng area, topped Hunton lime at 2,386 feet and was bottomed at 2,558 feet. Acidized with 3,000 gallons, it flowed 502 bbls. of oil in 24 hours, completed.

A. A. Vierson No. 2-A Jones, SE NW NW section 11-6-6, in the Konawa district, flowed 240 bbls. of oil through casing in 24 hours and was completed. Sand was topped at 2,415 feet, total depth 2,434 feet. Fleetborn Oil Corp. No. 1 Cahill, SW NW NE section 7-6-8, in the Sasakwa area, topped Gilcrease sand at 2,818 feet, total depth 2,930 feet, was shot with 10 quarts and swabbed 85 bbls. of oil in 24 hours, completed. Continental Oil Co. No. 2 Milsey, SE SW SW section 11-7-6, old well deepened from 4,221 feet, topped first Wilcox sand at 4,306 feet, second Wilcox at 4,315 feet and was bottomed at 4,318 feet. It pumped 160 bbls. of oil in 24 hours and completed.

Deep Rock Oil Corp. No. 2 Hagler, SE NW NE section 19-9-7, in the East Seminole pool, flowed 150 bbls. of oil in 24 hours through tubing after acidizing and was completed. Hunton lime, the production formation, was topped at 4,048 feet, total depth 4,095 feet. Magnolia Petroleum Co. No. 5 Browning, C W half SW NW section 14-10-6, flowed 110 bbls. of oil through tubing in 24 hours from Misener sand, topped at 4,167 feet. It was completed at total depth of 4,169 feet. Carter Oil Co. and others No. 3 Pipkin, C E half NE SW section 2-10-6, in the Keokuk area, topped Misener sand at 4,106 feet, Hunton lime at 4,119 feet, total depth 4,135 feet, made potential of 650 bbls. of oil and was completed. Tom Phillips and others No. 1 Wright, C N half NE SE section 27-11-6, was dry and abandoned at 4,167 feet, total depth. Plugging back to shut off water and shooting failed to get results.

New work in Seminole County: A. A. and R. W. Vierson No. 3-A Jones, NE SW NW section 11-6-6, moving in tools; Tilley-Vierson No. 2 Jones-Harjo, SE SE NW section 11-6-6, set 10-inch casing at 42 feet; Sunray Oil Co. No. 1 Williams, NW SE SE section 13-8-6, moving in tools; Pioneer Drilling Co. No. 1 Reed, SW SW SE section 27-8-8, rigging up rotary; Amerada Petroleum Corp. and Stanolind Oil & Gas Co. No. 1 Alexander, NE NW NE section 14-9-7, building rig; Wood Oil Co. No. 1 E. Reed, NW NW SE section 19-9-7, cellar and pits; Magnolia Petroleum Co. No. 6 Browning, C W half NW NW section 14-10-6, building rig.

In the South Keokuk area of Seminole County, Carter Oil Co. No. 1 Fannie Black, C E half NW NW section 23-10-6, flowed 55 bbls. of oil gross in five hours after acidizing; Hunton lime was topped at 4,248 feet, total depth 4,261 feet.

Estimated Production

Estimated daily average production of Oklahoma for the week ending March 14 and for the preceding week is as follows:

	Barrels	
	Mar. 14	Mar. 7
Allen	6,800	6,725
Asher-West Asher	875	875
Burbank	7,500	7,400
South Burbank	13,750	12,750
Balance Osage	22,750	22,500
Blackwell	4,500	4,400
Bristow-Slick	8,300	8,250
Chandler	3,950	3,925
Crescent	5,250	4,500
Cromwell	3,850	3,850
Cushing-Shamrock	11,500	11,250
Duncan district	3,900	3,900
Edmond	14,950	10,100
Fish	10,875	10,350
Fitts	51,400	43,250
Gray	1,650	1,750
Graham	3,800	3,800
Healdton	8,900	8,900
Hewitt	4,450	4,425
Holdenville	1,100	1,100
Keokuk	6,150	3,450
Konawa	1,850	1,650
Lucien	11,750	10,750
Marshall-Lovell	1,000	1,025
Oklahoma City	120,775	107,500
Papoose	1,075	1,050
Polo	3,600	3,050
Sasakwa and townsite	3,050	3,350
Sholem-Alechem	3,600	3,475
Seminole field:		
Bowlegs	11,175	9,375
Carr City	7,025	3,975
Earlsboro	7,775	7,450
South Earlsboro	850	825
East Earlsboro	11,400	10,800
Little River	13,700	13,675
East Little River	1,150	1,125
Maud	1,025	1,175
Mission	2,675	2,600
Seminole	10,850	10,800
East Seminole	1,925	2,050
Searight	4,350	4,325
Total Seminole	73,900	68,175
St. Louis-Pearson	23,650	22,950
Tatums	3,575	3,575
Tonkawa-Garber-Thomas	5,400	5,360
Wewoka	3,850	3,850
Yale-Jennings	4,050	4,000
Other pools	57,550	55,990
Total Oklahoma	514,775	473,200

Osage County

Sinclair Prairie Oil Co. No. 5 Osage, NE NW NE section 16-25-6, on tract 232, South Burbank area, flowed 1,410 bbls. of oil in 48 hours and was completed. Bartlesville sand was topped at 2,815 feet, total depth 2,842 feet. It flowed 654 bbls. of oil in 16 hours, cutting 4 per cent water, and was plugged back to 2,836 feet to complete. Carter Oil Co. and others No. 3 McKinley, NE SW SW section 35-26-6, topped Bartlesville sand at 2,780 feet, total depth 2,863 feet. It flowed 720 bbls. in 24 hours, gas gauging 4,000,000 feet, and was completed.

Lewis Production Co. No. 13 Osage, NW SW NW section 21-24-7, flowed 500 bbls. of oil in 24 hours and was completed after a 30-quart shot. Bartlesville sand was topped at 2,635 feet, total depth 2,665 feet. F. W. Files and Bay Oil Corp No. 4 Osage, SE SE SW NW section 19-23-9, had top of Bartlesville sand at 2,108 feet, total depth 2,150 feet. It was shot with 100 quarts, swabbed 121 bbls. in the first 24 hours, 42 bbls. in the next 24 hours, completed. J. E. Cooper No. 1 Osage, NW SW SW section 35-21-10, failed to get results by shooting and was dry and abandoned at 1,565 feet, total depth. Philtex Co. No. 18 Osage, SW NE SE section 21-25-12, had Bartlesville sand at 1,616 feet, total depth 1,681 feet in shale. Production was estimated at 10 bbls. of oil a day and it was completed as a repressure well. Peters Petroleum Corp. and others No. 8 Osage, SE NW NE section 24-24-7, old well deepened from 758 feet to 765 feet, pumped 40 bbls. of oil in 24 hours. Before deepening, it pumped at the rate of 12 bbls. daily.

The following new work in Osage County was reported: Murray Ringold No. 9 Osage, SE NW NE section 25-21-8, location; Ohio Osage Oil Co. No. 25 Osage, SW SW SW section 9-21-9, location; Higgins & Cooper No. 3 Osage, NE SE SE section 26-21-10, spudded; Comail Oil Co. No. 6 Osage, NW SE SW section 32-22-8, rigging up to deepen; Ray Branstetter No. 3 Osage, C W half E half SW section 28-22-11, location; Elfred Beck No. 1 Osage, SE SE NE section 6-23-7, wildcat, location; C. I. Sills No. 12 Osage, SE NW SE SW section 8-23-11, rigging up to deepen; Elfred Beck No. 2 Osage, NE NE SE section 21-24-8, location; Harland Oil Co. No. 76 Osage, SW NE NW section 25-24-11, location; Carter Oil Co. No. 1 Mary Kenworthy, NE NE NW section 16-25-6, location; Mid-Co. Oil Corp. No. 1 Osage, SE SW SW section 22-26-6, location.

Bay Oil Corp. No. 2 Osage, NE NW SW section 25-22-7, had Arbuckle lime at 2,897-2,910 feet, total depth, and was to be treated with acid. It was estimated good for 20 bbls. of oil natural from Hominy sand, topped at 2,800 feet, and 25 bbls. of oil from Arbuckle lime. Lewis Production Co. and Continental Oil Co. No. 12 Osage, SW NW SW section 16-24-7, topped Bartlesville sand at 2,594 feet, total depth 2,634 feet, swabbed 20 bbls. of oil, natural, was shot with 30 quarts at 2,619-33 feet and flowed 120 bbls. in 15 hours.

Pottawatomie County

Stanolind Oil & Gas Co. and Amerada Petroleum Corp. No. 1 Rushing, SW SW SE section 32-11-4, in the Shawnee pool of Pottawatomie County, flowed 240 bbls. of oil in 24 hours through tubing and was completed. Earlsboro sand was topped at 4,435 feet, total depth 4,460 feet.

One new test was started in Pottawatomie County. Gulf Oil Corp. No. 1 Bois-Clair, SW SE SE section 21-6-4, was building rig.

Conly Drilling Co. and others No. 2 Vinson, SW NE NE section 13-7-4, in the St. Louis district of Pottawatomie County, topped Wilcox sand at 4,062 feet and at 4,072 feet, total depth, flowed 300 bbls. of oil in 24 hours. Sinclair Prairie Oil Co. No. 4 Deatherage, SW NE NW section 28-7-4, swabbed 270 bbls. of oil in 12 hours after shooting with 10 quarts and 30 quarts. Simpson Dolomite was topped at 4,110 feet, total depth 4,162 feet.

Hughes County

No wells were completed in Hughes County, but the following work was reported: Mid-Continent Petroleum Corp. No. 1 Hampton, SW SW NE section 1-9-8, set 10-inch casing at 65 feet; Sinclair Prairie Oil Co. No. 6 Oliphant, NW NW SE section 1-9-8, cellar and pits; same operator's No. 7 Oliphant, SE NW SE section 1-9-8, cellar and pits; Manahan Oil Co. and others No. 4 Dixon "C," NE NW NE section 12-9-8, set 10-inch at 42 feet. All of these tests are in the Olympic pool.

Stanolind Oil & Gas Co. No. 2 Harris, SW NE NW section 8-6-8, in the Hughes County sector of the Sasakwa area, topped Wilcox sand at 4,142 feet, total depth 4,144 feet, flowed 380 bbls. of oil in 24 hours.

Okfuskee County

Carter Oil Co. had the only Okfuskee County completion at its No. 1 Hicks, C NE SE section 11-11-8, in the Dill pool. Hunton lime was topped at 3,908 feet, total depth 3,976 feet. It was acidized and flowed 310 bbls. of oil and 280 bbls. of water in seven hours.

Oklahoma County

Pure Oil Co. completed the biggest producer to date on the north side of the Edmond field of Oklahoma County at its No. 5 Malm, NW SE SW section 30-14-3w. It flowed 925.25 bbls. of oil in four hours, to give it a 24-hour potential of 5,551.50 bbls. Production was from second Wilcox sand, topped at 6,638 feet, total depth 6,696 feet. Gas gauged 11,500,000 feet.

Slick-Urschel Oil Co. and others No. 1 Owen C-40, SE cor. section 19-13-3w, in the Britton area, plugged back from old total depth of 6,789 feet, was acidized and flowed 609 bbls. of oil net in seven hours. On potential test it flowed 625.95 bbls. in four hours, to give it a 24-hour potential of 3,755.70 bbls., completed. Gas gauged 12,000,000 feet.

New Oklahoma County work: Pure Oil Co. No. 7 Malm, SW NE SW section 30-14-3w, cellar; same operator's No. 8 Malm, NE SW SW section 30-14-3w, location; Harrell-Davis Oil Co. No. 1 Hayes, SE SW NE section 20-13-3w, cellar and pits; H. R. Hollenback and others No. 1 Cooper, NW NW NE section 15-11-1e, wildcat northeast of Newalla, rigging up rotary.

Lincoln County

Stanolind Oil & Gas Co. and Amerada Petroleum Corp. No. 7 Rice, NE cor. section 11-14-3, in the Chandler area of Lincoln County, flowed 191 bbls. of oil in 24 hours after a shot and was completed. Production was from Skinner sand, topped at 4,223 feet, total depth 4,261 feet.

Fred McDuff No. 1 Jacob, NE NE SE section 10-15-5, had first Wilcox sand at 4,305 feet, second Wilcox 4,334 feet, total depth 4,345 feet, and was dry and abandoned. Magnolia Petroleum Co. No. 2 Rose, SE SE SE section 2-14-3, plugged back from 5,033 feet to 4,850 feet, had a hole full of water after shooting and was dry and abandoned.

Only new Lincoln County test was the Stanolind Oil & Gas Co. and Amerada Petroleum Corp. No. 2 Adams,

NW NE NE section 5-14-3, building rig.

In the Laffoon area of Lincoln County, Amerada Petroleum Corp. and others No. 1 Laffoon "A," SE NE NE section 9-13-6, had first Wilcox sand at 4,153-60 feet, drilled to 4,170 feet, acidized and swabbed 386 bbls. of oil, gross, in 13 hours; topped second Wilcox sand at 4,171 feet, total depth 4,260 feet and swabbed 1,138 bbls. of oil in 24 hours.

Noble County

Shell Petroleum Corp. No. 1-A Watts, SW SW SE section 22-22-2w, the only Noble County completion, was dry and abandoned. Wilcox sand was topped at 4,952 feet, total depth 4,955 feet. It had showings of oil, with water, and was plugged back, acidized and pipe perforated, but all efforts to make a producer failed.

Two new tests were started in Noble County, both in the Billings area. Phillips Petroleum and Shell Petroleum Corp. No. 1-A Washburn, NW NW SW section 15-23-2w, and same operators' No. 1-A Brumfield, NW SW SW section 22-23-2w, were cellars.

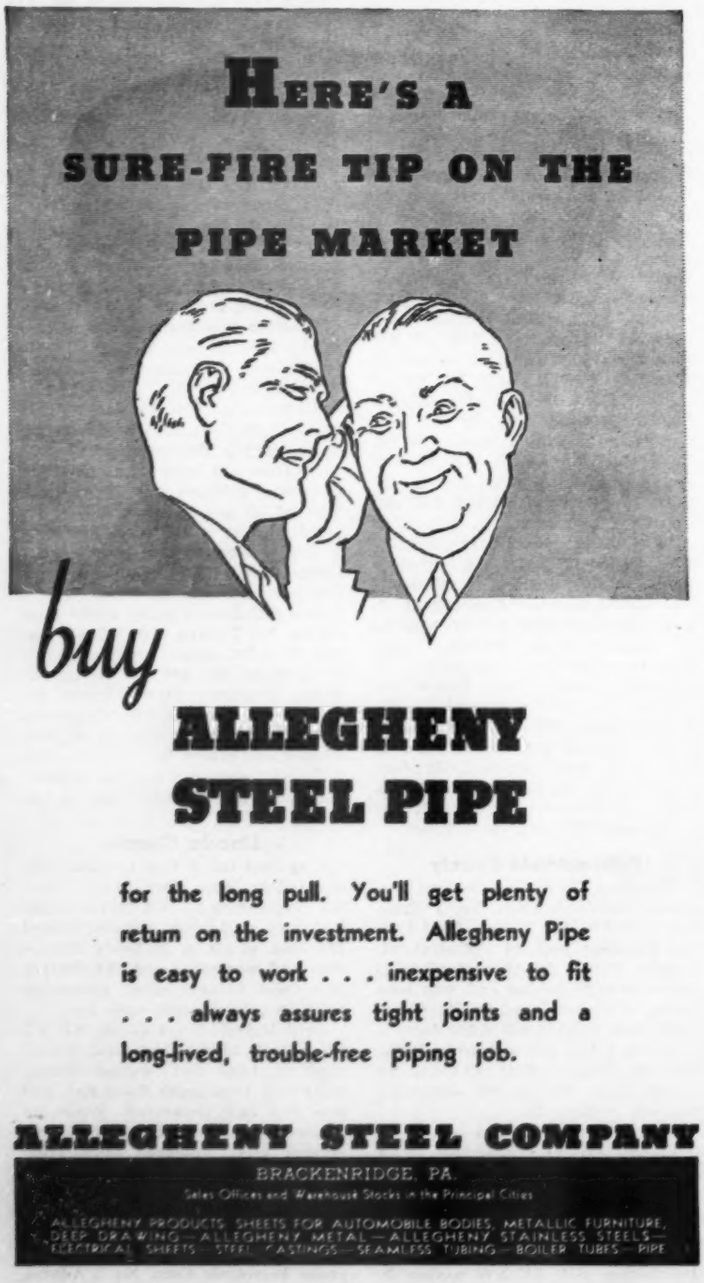
Logan County

Two new tests in Logan County were reported. Twin State Oil Co. No. 2 Pfeiffer, NW NW SW section 33-20-2w, was a rig. Mid-Continent Petroleum Corp. No. 3 Campbell, NW SE NE section 33-17-4w, was a location.

Sinclair Prairie Oil Co. and Slick-Urschel Oil Co. No. 1 Koatsch, SW SW SW section 23-15-3w, in the Seward area of Logan County, was opened up after being shut in for several months, awaiting erection of tanks, and flowed 85 bbls. of oil per day. Later, it flowed 65 bbls. per day. Operators were to shoot off bottom of casing and attempt to increase gas.

Kay County

Argo Oil Co. No. 1 Myers, NE SW SW SW section 20-25-1w, in the Tonkawa area of Kay County, was cleaning out and swabbing after topping Wilcox sand at 4,430 feet and drilling to 4,467 feet without any increase in oil or water. It previously had swabbed 75 bbls. of oil and showing of water from pay at 4,234-41 feet, and swabbed 35 bbls. of oil and 15 bbls. of water from Mississippi lime, topped at 4,260 feet.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Southwestern Oklahoma

There was little to enthuse over from southwestern Oklahoma, the only two completions being failures. John Nicholas abandoned his Comanche County wildcat, the No. 1 Hauseholder, NE NE SW section 8-2-10w, at 960 feet, total depth. It had sand showing gas at 930-32 feet. Haughton Royalty Co. No. 1 Price, SW SW NW section 27-2-10w, also in Comanche County, missed the sand and was dry and abandoned at 1,050 feet, total depth.

New work in southwestern Oklahoma was as follows: In Grady County, Magnolia Petroleum Co. No. 1 Miller, NE NE NE section 28-3-5w, rigging up to deepen. In Stephens County, Raisen Brothers No. 4 Crosby, SW SW SW section 23-1s-5w, drilling below 53 feet with machine. In Jackson County, Gulf Oil Corp. No. 4 Boucher, SE SW SW section 32-1-19w, rigging up rotary; H. W. Lee No. 1 W. B. Wright, NE NW SE section 19-1-19w, wildcat location. In Beckham County, West Oak Gas Co. No. 1 Baldwin, C SE NE section 10-9-25w, location.

Carter County

One small pumper was completed in Carter County. Shell Petroleum Corp. No. 61 Wirt Franklin, SW NE NE section 8-4s-3w, in the Healdton pool, had sand series beginning at 996 feet, total depth 1,105 feet, plugged back to 1,098 feet, pumped 30 bbls. of oil and 11 bbls. of water in 24 hours, completed.

New work in Carter County: Cox & Hamon No. 1 Cassidy, C E half NE NW SE section 6-2s-2w, location: same operator's No. 1 Mena, C W half NE NW SE section 6-2s-2w, location; same operator's No. 2 Mena, C E half SE SW NE section 6-2s-2w, location.

Texas Co. and others No. 1 Cathey, SE NE NE section 6-5s-1w, wildcat, southeast of the Hewitt field in Carter County, total depth 4,164 feet, pumped as follows on four successive days: 85 bbls. of oil in six hours, 85 bbls. in eight hours, 45 bbls. in eight hours and 3 bbls. in one hour. Tubing and rods were being pulled to clean out.

Sinclair Prairie Oil Co. No. 22 Million & Thomas, NW SW SE section 5-4s-3w, the deep test in the Healdton field, was drilling ahead below 3,149 feet in lime. On successive days it swabbed and flowed while drilling as follows: 42½ bbls. of oil, 60 bbls., 90 bbls., 67 bbls., 55 bbls., 50 bbls. and 50 bbls.

Creek County

Carpenter No. 1 Trent, NW SW SE section 21-17-11, was abandoned at 2,330 feet, total depth. It had sand at 2,311-2,321 feet. Smith and others No. 2 Blevens, SW NW SE section 25-14-9, had Prue sand at 2,030-58 feet, total depth, pumped 30 bbls. of oil in 24 hours and was completed. Kemp and others No. 1 Marrow, NW NW SW section 1-17-8, topped Mississippi lime at 3,050 feet and was dry and abandoned at 3,070 feet, total depth. W. C. McBride, Inc., No. 2 Starr, SE SE NE section 17-18-7, old well deepened from 2,520 feet to 2,600 feet, was acidized and pumped 8 bbls. of oil.

New work in Creek County: Irik Oil Co. No. 2 Hawkins, SW NE SW section 15-18-8, location; L. B. Jackson No. 1 Coyle, NW SW NW section 1-17-8, location.

Marshall County

One new test was started in Marshall County. Levelle Coal Co. No. 4 Brunt, NW NE NW SE section 1-8s-5, was a machine.

Roger Mills County

The deep wildcat test in Roger Mills County has been given up as a bad job. Anderson-Kerr and others No. 1 Teeter, C SE SE section 2-17-25w, had Panhandle Big Lime at 4,195-6,503 feet, total depth, and was dry and abandoned.

Grant County

Southern Oil Co. and others failed to make a producer of the No. 1 Allen, SW SW SE section 36-26-4w, wildcat in Grant County, and it was dry and abandoned at 5,476 feet, total depth.

Muskogee County

Morrison No. 1 well, SW SW NE section 18-14-16, had Booch sand at 1,006-16 feet, total depth 1,722 feet, and produced 30 bbls. of oil in 24 hours, completed. Guinn and others No. 1-A Asbury, NE SE NW section 31-16-15, topped Dutcher sand at 1,477 feet, and was dry and abandoned at 1,556 feet. Lightner No. 1-A Franklin, SW NW SW section 7-14-16, pumped 8 bbls. of oil from 1,550 feet, total depth, and was completed.

Two new tests in Muskogee County were started. Naphan & Jarrett No. 2 Fluche, NE NE SW section 17-14-17, was spudding. Foltz No. 2 Barnett, SW SW NE section 17-14-17, was drilling below 160 feet.

Okmulgee County

Stekoll No. 10 Hawkins, SE NW SE section 6-11-12, was abandoned at 1,554 feet, total depth, in sand. Edwards No. 2 Monday, C SE NE section 33-15-14, had Red Fork sand at 1,495-1,505 feet, total depth 1,700 feet, gauged 4,000,000 feet of gas and was completed. Klingensmith No. 13 Farr, CWL NE NW section 36-16-11, topped sand at 1,810 feet, total depth 1,855 feet, was shot and swabbed 55 bbls. of oil in 24 hours, completed.

New work in Okmulgee County was as follows: Cusack Oil Co. No. 1 Reading, NE cor. section 36-15-12, location. Scott and others No. 1-A Lowery, NE NE SE section 23-16-14, rigging up machine. Klingensmith No. 14 Farr, SW NE NW section 35-16-11, rig. Downing No. 6-A Colbert, C S half NW section 1-15-14, drilling below 350 feet.

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The Tank, Inc., newly organized Oklahoma corporation, announces purchase of 500 storage tanks in this state to be cut down and sold for reerection and steel sheet purposes. A complete field force has been organized for this work and operations will begin immediately.

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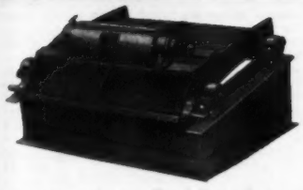

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Among Gulf Coast Drilling Contractors

Al Buchanan of San Antonio completed the thirty-third producer for the Plymouth Oil Co. in the Plymouth field, San Patricio, and is on the sand with four other wells in the field. In the same county two of his rigs are drilling deep wildcat tests for the Stanolind Oil & Gas Co. and Benedum & Trees Oil Co. The remainder of his 14 rigs are drilling in the Loma Novia and Seven Sisters fields of Duval County. In the former field he is drilling for Humble and Texas Co., and in Seven Sisters for Shell. Pan American, Humble, Mid-Continent and Blanco Oil Co.

Trinity Drillers, Inc. of San Antonio have two rigs active in the Lopez field of Webb County drilling for the Superior Oil Co. on the No. 7 Billings, and for the Montour Production Co. on the Lopez lease. In Live Oak County a wildcat drilling for R. H. Feltner on the J. T. Carter tract tested salt water at 2,962 feet and was awaiting orders.

George Echols has completed Taylor Refining Co. well in the Saxet field, Nueces County, and has received contract from the same company to drill a test in the new Saxet Heights field in the same county. A rig is being moved in for a 7,500-foot wildcat test to be drilled in Nueces County for Barnsdall Oil Co. and others. At Gillis in Calcasieu Parish, La., Fohs Oil Co. No. 1 Frost is being deepened after testing salt water in 6,200-foot sand. In the Placedo field, Sun Oil Co. No. 3 J. J. Marek is bottomed in oil sand at 4,728 feet and 7-inch casing has been cemented at 4,755 feet. Two active rigs are located in Duval County, one in the Government Wells field for Sun Oil Co., and one is located on the Welded Ranch for Santa Clara Oil Co.

Glenn H. McCarthy extended the new Amelia field approximately 2 miles to the northwest and opened a new producing sand for the field when his No. 1 Longe was completed for an initial production of 75 bbls. of distillate per day through a one-thirty-second inch adjustable choke with tubing pressure 1,975 pounds and casing pressure 2,200 pounds. The hole was originally drilled to 6,818 feet, and was plugged back to 6,004 feet, and completed through perforated casing from 5,835-55 feet. Humble Oil & Refining Co. No. 7 White at the Anahuac field has been completed for a producer and the rig is being moved in for No. 8 White.

Smith & McDannald encountered an unusual subsurface condition at their No. 1 Vallos located in the South Houston field, Harris County. The test was spudded a few weeks ago and has just completed its fourth sidetracking job below 1,300 feet, which was caused by a cavity. In the same field District No. 6 for the Stanolind Oil & Gas Co. is drilling below 1,200 feet. Eight active rigs are located as follows: One in the East Texas field for Tide Water Oil Co., one in the Cayuga field for the same company, two in the St. Martinsville field for the Continental Oil Co. and Tide Water Oil Co.; one in the Jennings field for Shell Petroleum Corp., one in Jefferson County for Atlantic Oil & Production Co.; one in Hastings for Stanolind Oil & Gas Co., and one in Louise for Pure Oil Co.

Rutherford Drilling Co. is preparing to complete two extension wells in the Bay City field for Skelly Oil Co. No. 5-B Cobb is bottomed in oil sand at 7,503 feet and 7⅝-inch casing has been cemented on bottom. It will extend the field approximately a half mile west. No. 1 Metzger cored oil sand to a total depth of 7,504 feet, and has cemented 7⅝-inch casing on bottom. It extends the field almost a 1,000 feet to the east. No. 4-B Cobb is drilling below 6,200 feet.

Rowan Drilling Co. has 11 active rigs located from Coastal Louisiana to the West Texas district. Two are in the Monument area in New Mexico for Amerada Petroleum Corp., two are located on wildcat prospects for themselves in West Texas and Eunice, N. M., two in Cayuga for Tide Water Oil Co., and Stanolind Oil & Gas Co., one in Cheneyville in Rapides Parish, La., one in the Tomball field for Amerada Petroleum Corp., and two in the Pearsall field in Southwest Texas for the same company.

W. Claude Smith is preparing to complete No. 12-A Pierce at the Pickett Ridge field in Wharton County. The hole is bottomed at 4,706 feet and 7-inch casing has been cemented at 4,700 feet.

Supervising drilling operations on some 12 active rigs, all of which are located from the Texas Gulf Coast to Coastal Louisiana and the East Texas district, is the job being fulfilled by Grant Lindsey, drilling superintendent for Smith and McDannold. Picture was taken at the South Houston field on Smith and McDannald No. 1 Vallos.

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Texas and Louisiana Gulf

AMELIA TEST PLUGGED BACK AND MADE DISTILLATE WELL

By F. L. SINGLETON

HOUSTON, Tex., Mar. 16.—Glenn H. McCarthy No. 1 Longe extended the Amelia field, northern Jefferson County 2 miles to the northwest and opened a new producing horizon when it was completed at a corrected plugged back depth of 6,004 feet and flowed 75 bbls. of distillate per day through a one-thirty-second inch choke with tubing pressure 1,975 pounds and casing pressure 2,200 pounds. There was no showing of salt water and the gravity of the oil tested 55 degrees.

No. 1 Longe was originally drilled to a depth of 6,814 feet after coring salt water sand from 6,761-87 feet which is the approximate producing depth of the discovery well, and was plugged back to its present depth when an electrical coring test was made. The top of the cement plug inside the 7-inch casing was found at 6,004 feet, and after the casing had been perforated with 50 shots from 5,835-55 feet, the following screen setting was made, 1 foot 8 inches of back-pressure valve on the bottom of 145 feet, 7 inches of 5-inch O. D. blank liner and 23 feet, 10 inches of 5-inch O.D. 10-gauge screen and 22 feet 3 inches of 5-inch O. D. blank liner on top, sealed in the 7-inch casing with a 7-foot, 10-inch brown packer. Two and a half inch tubing was swung at 5,986 feet, and after the well was washed with clear water for 1 hour and 10 minutes, and then swabbed to 750 feet, it began cleaning itself.

Production is from the Marginulina sand or 422 feet above the producing horizon of Humble Oil & Refining Co. No. 1 Langham, which is producing from the Frio sand at a depth of 6,777 feet. The top of the Marginulina was encountered in No. 1 Longe at 5,826 feet, and since the perforation was made only 9 feet below the top of the sand, it is the general opinion that the well is bottomed in the top of the gas cap, and that a good body of oil sand underlies this zone which is characteristic of the formation. This theory is substantiated by the announcement of location for the McCarthy No. 2 Longe, situated 660 feet north of No. 1 and 330 feet from the east line of a 100-acre lease in the H. Williams Survey.

East of the discovery well about 3,000 feet, Humble Oil & Refining Co. No. 1 Broussard, in the C. Williams Survey, is coring in shale below 6,700 feet and has the appearance of being a dry hole. The Discorbis was topped at 5,680 feet, Heterostegina at 6,050 feet and the Marginulina at 6,146 feet. Based on the latter marker it is about 41 feet lower than the discovery well, No. 1 Langham which is considered an edge well. To the west in the A. Savery Survey, Humble No. 2 Miller is drilling in shale below 6,200 feet, and is reported checking several feet higher than the company's No. 1 Miller, located due south which was abandoned several hundred feet above the producing horizon.

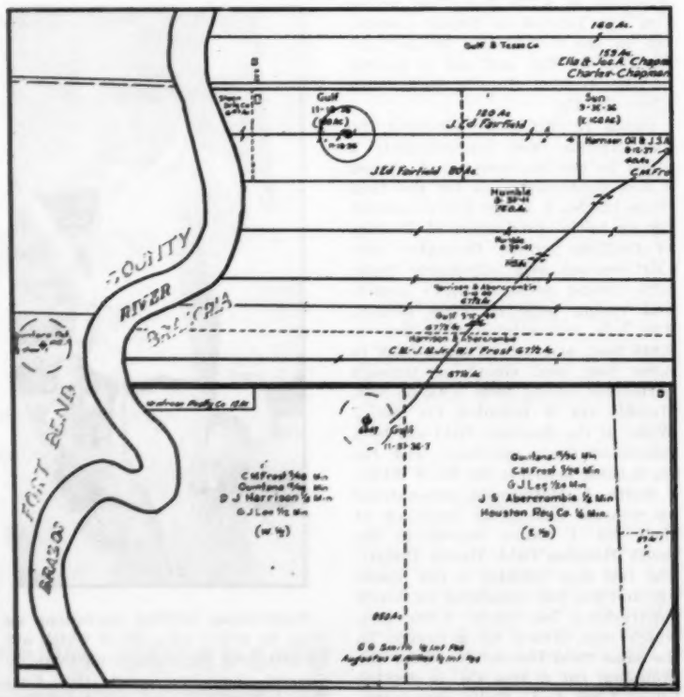
Lockridge Prospect

The prospects of commercial production being developed on the Lockridge prospect, western Brazoria County, seem favorable as a result of a drill stem test made on Gulf Oil Corp's No. 1 Fairfield which tested 1,500 pounds of pressure and 30 feet of oil cut. The test was made in 7 feet of sand topped at 6,267 feet and bottomed at 6,274 feet. Seven-inch casing has been cemented at 6,255 feet, and a test is scheduled to be made during the week. This area has been looked upon as favorable for a number of years as several important showings have been encountered in several of the seven tests that have been drilled. No. 1 Fairfield is the second test to be drilled by the company within the past few months, being located approximately 4,500 feet due north of No. 1 Wilkes which was abandoned after testing salt water at a total depth of 6,647 feet. Location is in the A. Robinson survey.

Stanolind Oil & Gas Co. No. 1 State, a south offset to the discovery well, and the third well to be drilled in the Turtle Bay field, Chambers County made a 11-minute drill stem test from 6,590-6,615 feet, the total depth, and tested 1,560 feet of oil and 60 feet of salt water and mud with 75 pounds of pressure through a three-eighths inch choke on top and a quarter-inch choke on bottom. Since the high part of the structure was expected to be out in the bay, the salt water showings is somewhat of a surprise and definitely changes the trend of the field, which is now expected to extend due east or to the northeast. Based on top of the oil sand reported topped at 6,607 feet, No. 1 State is 13 feet lower than the discovery well and 6 feet lower than No. 1 Cooper Heirs, both of which have the appearance of being edge wells.

Anahuac Field

To the southeast, in the Anahuac field, Humble Oil & Refining Co. completed four wells for producers, and announced location for one well. In section 57, No. 9 Clark flowed 27 bbls. per hour through a quarter-inch choke from a total depth of 7,085 feet; No. 4 Tyrell in section 52 flowed at the rate of 30 bbls. per hour through a quarter-inch choke from a total depth of 7,082 feet. On the extreme east side of the field, No. 1 Wilcox extended the field a short distance to the east when it flowed 27 bbls. per hour through a quarter-inch choke from a total depth of 7,085 feet. In the north part of the field, No. 7 White located in the J. McGahey Survey was completed at 7,090 feet, and flowed 28 bbls. per hour through a quarter-inch choke. Derrick is being built for No. 1 C. A. Loard, located on the extreme east side of the field in section 50, H. & T. C. Survey.



Gulf Oil Corp. No. 1 Fairfield on the Lockridge Prospect, western Brazoria County, is preparing to test after showing gas and some distillate on a drill stem test made in 7 feet of sand bottomed at 6,274 feet; dry holes are indicated by broken circles

(Map courtesy of W. W. Zingery, Second National Bank Bldg., Houston, Tex.)

Daily Production

Estimated daily average production of Gulf Coastal fields for the week ending March 12 was as follows:

TEXAS COAST

	Bbls.
Anahuac	5,437
Barbers Hill	15,867
Conroe	41,567
High Island	6,392
Hull	5,579
Humble	3,508
Manvel	7,536
Mykawa	2,884
Pierce Junction	4,267
Sugarland	5,599
Thompson	10,675
Tomball	6,493
Dirks	3,529
Greta	16,124
Fettus	4,127
Plymouth	7,436
Refugio	4,413
Saxet	6,825
Tomoconnor	3,097
Miscellaneous	64,788
Total	227,143

LOUISIANA COAST

Black Bayou	3,256
Bosco	14,028
Bayou St. Dennis	3,098
Caillou Island	10,934
Cameron Meadows	5,697
Gillis	13,453
Iowa	19,086
Lake Barre	9,287
Leesville	14,835
Roanoke	5,439
Sulphur	3,837
Tepetate	2,256
Miscellaneous	30,014
Total	135,319
Total Gulf Coast	362,462

Possible Extension

Texas Co. No. 1 Joseph Marek, located about a mile northwest of the Pickett Ridge field which last week appeared as a possible extension well after testing 30 feet of clean oil on a drill stem test from 4,597-4,619 feet, was cored deeper and encountered salt water sand and is drilling ahead below 5,010 feet. It will be carried to the contract depth, and will be plugged back and tested in the sand encountered at 4,500 feet. Texas Co. No. 12-A Pierce located in the I.&G.N. Survey No. 38 is bottomed in oil sand at 4,706 feet, and is preparing to test after 7-inch casing had been cemented at 4,700 feet.

Two extension wells are scheduled to be completed at the Bay City field, Matagorda County by Skelly Oil Co. On the east side of the field No. 1 Metzger is bottomed in 69 feet of Frio sand at 7,504 feet and 7⅝-inch casing has been cemented on

(Continued on Page 180)

Kansas Developments

By
DAL DALRYMPLE

MARGAY'S BIG WELL IN ELLIS, TWO NEW POOLS IN RUSSELL

The predicted boom in Kansas oil field activity in 1936 is getting off to a good start, with work beginning at numerous wildcat locations in widely scattered sections of the state and many new tests starting in proven areas, especially in some of the newer areas opened to production last year, Several significant wildcat strikes already have been made this year, three discoveries being added to the fast growing list in the past week.

One of the important strikes was the discovery of a deeper pay zone in the Bemis pool of Ellis County. Margay Oil Co. and others No. 1-B Bemis, SW cor. section 15-11-17w, was estimated good for 3,000 to 5,000 bbls. a day without acidizing. It is in Siliceous lime, topped at 3,380 feet, total depth 3,382 feet. It was to be deepened after initial test. Operators were running 5-inch casing. The well is an east offset to the company's No. 7 Bemis, discovery well of the field in the Oswald lime pay zone. Expectation is that redrilling of the field to the Siliceous pay will result from the Margay strike.

New Pools in Russell

Coralena Oil Co. has opened the thirty-third oil pool in Russell County with the No. 1 Disken (Trapp), SE cor. section 30-15-13w, wildcat midway between the Ochs and Rude pools, west of the Sellens area. Siliceous lime was topped at 3,252 feet, drilled 1 foot in, and it filled with 2,900 feet of oil in 18 hours, but it had not been tested. Six-inch casing was being set.

Sam Murphy and others No. 1 Anschutz & Schaffer, SW cor. section 10-15-13w, wildcat north of the Sellens pool, in Russell County, looks like an extensioner of that area or a new pool opener. After swabbing 4 bbls. of oil an hour from 3,305 to 3,315 feet in Siliceous lime, it was drilled 4 feet deeper and operators were preparing to acidize before a production test.

A Russell County well that caused wide comment last year when it was completed as a big producer supposedly from Topeka lime, now is said to be producing from Oswald lime. It is Hartman & Blair No. 1 Rouback, SE SE NW section 2-14-15w, in the Sullivan area, southwest of Russell. Regarded as a freak Topeka lime well, it made potential of 4,076 bbls. nearly a year ago. A new potential test the past week gave it a rating of 3,010 bbls., that being the natural flow in 24 hours. Decision to classify it as an Oswald lime well, rather than a Topeka lime producer, came after considerable study by geologists and petroleum engineers, who believe it is producing from the Oswald through a fissure. In distillation tests, the oil from No. 1 Rouback proved identical with that from other Oswald lime producers in the area, and was of different gravity from oil taken from Topeka lime in a well on an offset lease. Depth at which Topeka lime was found in the Rouback also was lower than in the offset wells, and no other well found sufficient Topeka pay to make a commercial producer.

Stearns & Streeter completed the biggest Russell County producer of the week in their No. 2 Miller, NW NE NW section 31-14-13w, in the Hall pool. Top of Oswald lime, the producing horizon, was 2,854 feet; total depth, 2,903 feet. It swabbed 6½ bbls. of oil per hour for 24 hours and then, after being treated with 8,000 gallons of acid, made a potential of 1,334 bbls. of oil.

Signal Oil Co. No. 2 Weeks, SW SW NW section 34-15-13w, Sellens area, made a potential of 781 bbls. of oil after acidizing. Siliceous lime was topped at 3,330 feet; total depth 3,333 feet; completed. Darby Petroleum Corp. No. 1 Steinert, SW cor. section 25-15-15w, pumped 462 bbls. of oil in 24 hours after acidizing with 5,000 gallons. Gravity of the oil was 42.5 degrees. Oswald lime was topped at 3,128 feet; total depth, 3,139 feet; completed.

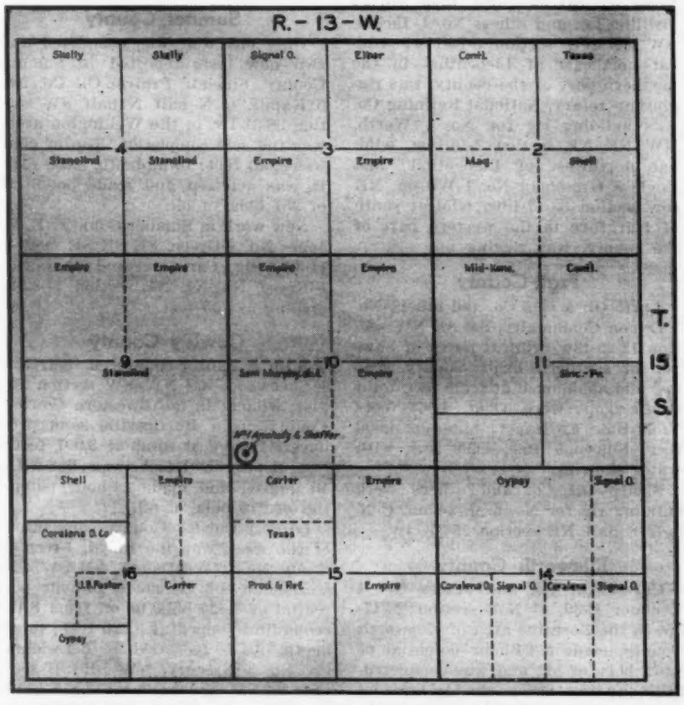
In the Gorham area, Bridgeport Machine Co. No. 3 Witt, SW NW SW section 3-14-15w, topped Oswald lime at 3,034 feet; total depth, 3,110 feet. It was acidized and pumped 776 bbls. of oil in 18 hours, later making a potential of 800 bbls. of oil. Central Petroleum Co. No. 2 Witt, SE cor. section 3-14-15w, had Gorham sand at 3,272-75 feet, total depth, and made 24-hour potential of 631 bbls. of oil. Same operator's No. 1 Foster "B," SW SW NE section 3-14-15w, made 24-hour potential of 349 bbls. of oil and was completed. Oswald lime was topped at 3,040 feet; total depth, 3,132 feet.

One Russell County wildcat failed to find commercial production and was dry and abandoned. It was Hartman & Blair No. 1 Boxberger "B," NE SE SW section 5-14-14w, which had a hole full of water in Siliceous lime at 3,341-42 feet, total depth.

The following new work in Russell County was reported: Joe Aylward No. 1 Rusch, SE SW NW section 19-12-15w, moving in material; Darby Petroleum Corp. and Continental Oil Co. No. 1 Letsch, SE NE NW section 34-14-13w; Empire Oil & Refining Co. No. 3 Crawford, NW SW SW section 2-14-15w, location; Skelly Oil Co. No. 1 Ehrlich, SW SW NE section 25-14-15w, building rig.

Gulf Oil Corp. No. 2 Ehrlich, SE SW NW section 1-14-15w, in Russell County, topped Oswald lime at 3,044 feet; total depth, 3,079 feet; swabbed 11 bbls. of oil an hour for six hours, and was acidized but had not been tested. Empire Oil & Refining Co. No. 2 Crawford, SW cor. section 2-14-15w, had Gorham sand at 3,292-93 feet, total depth, and pumped 1,029 bbls. of oil in 16½ hours.

Sam Murphy and others No. 1 Anschutz & Shaffer, SW cor. section 10-15-13w, wildcat north of the Sellens pool, topped Arbuckle lime at 3,302 feet; set 5-inch pipe at 3,307 feet; drilled to 3,323 feet, filled with 500 feet of oil in 24 hours, and was cleaning out, but had not been tested.



The Murphy well in SW cor. section 10-15-13w, Russell County, Kansas, is looking like a new pool opener or north extension of the Sellens area

(Map courtesy Mid-Continent Map Co., Wichita, Kans.)

Estimated Production

Estimated daily average production in Kansas for the week ending March 14 and for the preceding week is as follows:

	Barrels	
	Mar. 14	Mar. 7
Oxford City	7,100	7,375
Burrton	14,700	11,950
Ritz-Canton	7,100	7,300
Hollow-Nikkel	4,100	4,325
Voshell	3,900	2,675
Ellsworth County:		
Lorraine-So. Lorraine	7,403	9,289
Other pools	1,648	1,964
Rice-Barton Counties:		
Chase	9,020	8,473
Raymond	2,158	2,561
Silica	6,199	5,971
Keesling	1,305	1,909
Miscellaneous Rice	2,680	2,545
Miscellaneous Barton	1,235	1,173
Russell County:		
Fairport	2,675	2,225
Gorham	3,479	4,460
Russell	2,685	3,300
Other pools	7,338	6,370
Sedgwick County:		
Valley Center	1,387	1,365
Greenwich	1,342	1,390
Robbins	1,771	1,463
Eastborough	916	896
Other pools	582	485
Ellis County	436	749
Kingman County	550	707
Stafford County	1,843	2,604
Greenwood County	9,500	10,450
Butler County	18,310	18,200
Other fields	19,788	19,326
Total Kansas	141,150	141,100

Reno County

Texas Co. had the biggest Reno County producer of the week at its No. 2 Collins, NE NE SE section 17-24-4w, on the southwest trend of the Burrton area. It topped Chat at 3,302 feet; total depth, 3,380 feet, and made a potential of 314 bbls. of oil. Other Reno County completions also were in the Burrton area. Olson Drilling Co. and others No. 2 Regier, C SW SE section 24-23-4w, topped chat at 3,255 feet; total depth, 3,374 feet; was acidized and on completion test made potential of 201 bbls. of oil. Phillips Petroleum Co. and Vickers Petroleum Co. No. 1 McElwain, C NW SE section 10-24-4w, produced 150 bbls. of oil and 155 bbls. of water on 24-hour potential test and was completed. Chat was topped at 3,319 feet; total depth, 3,398 feet; plugged back to 3,350 feet. Olson Drilling Co. and Shell Petroleum Corp. No. 6 Roberts, C NE NW section 25-23-4w, topped Chat at 3,251 feet; Hunton lime, 3,634 feet; had a hole full of

water at 3,641 feet, total depth; plugged back to 3,350 feet; made potential of 42 bbls. of oil and was completed.

New work in Reno County was as follows: Olson Drilling Co. and Shell Petroleum Corp. No. 4 Johnson, C NE NW section 24-23-4w, location; Shell Petroleum Corp. No. 1 Welch "A," C SE SW section 9-24-4w, rigging up rotary; Sinclair Prairie Oil Co. No. 2 Seedle, SW SW NE section 17-24-4w, rotary rig; Empire Oil & Refining Co. No. 1 Holtje, NW NW NE section 9-26-4w, building rig; Shell Petroleum Corp. No. 1 Nunemaker, C S half S half NW section 11-26-9w, rigging up rotary.

Rice and Barton Counties

In the Rice County sector of the Silica pool, Bradley Oil Co. completed No. 3 Wendell, SW SE NE section 32-19-10w, for a 24-hour potential of 1,308 bbls. of oil. Production was from Siliceous lime, topped at 3,289 feet; total depth, 3,313 feet. In the Chase area, Herndon Drilling Co. No. 1 Smith, NE NW SE section 16-20-9w, topped Siliceous lime at 3,253 feet; total depth, 3,260 feet; produced 861 bbls. of oil in 15 hours and was completed.

New work in Rice County was as follows: C. B. Davis and others No. 8 Dueser, NW SW SW section 31-19-10w, cellar; Derby Oil Co. No. 1 Callis, SE SE SW section 32-19-9w, location; Gulf Oil Corp. No. 5 Smith, SW SE NE section 16-20-9w, rigging up rotary; and two wildcats, Dickey Oil Co. and Continental Oil Co. No. 1 Newkirk, NE NE SW section 11-18-7w, location, and Glimac Oil Co. No. 1 Sargent, SE cor. section 31-18-6w, rig.

Two wells in the Barton County sector of the Silica pool were completed. Continental Oil Co. No. 2 Risse, SW SW SE section 36-19-11w, topped Siliceous lime at 3,278 feet; total depth, 3,289 feet; swabbed 419 bbls. in eight hours; was acidized and made 24-hour potential of 1,919 bbls. of oil. Gulf Oil Corp. No. 7 Steckel, NW NE NE section 1-20-11w, had Siliceous lime at 3,268½ feet; total depth, 3,292 feet; pumped 409 bbls. of oil in 24 hours; was acidized and made potential of 1,307 bbls. of oil. The other Barton County completion was a wildcat failure. Torry & Feaster and others No. 1 Kimpler, SE NE NE section 31-18-11w, had Siliceous lime at 3,423-41 feet; total depth, 3,468 feet; had a hole full of oil at 3,441 feet, but water intruded on deepening. It was plugged back to 3,462 feet; was acidized and shot, but oil failed to increase, and it was dry and abandoned.

New work in Barton County: Texas Co. No. 1 F. Bloomer, NW NW NE section 36-17-11w, location; Sinclair Prairie Oil Co. No. 1 Isern, SE SE SW section 25-19-11w, rigging up rotary; Phillips Petroleum Co. No. 3 Matzek, SE NW NE section 36-19-11w, building rig.

Slick, Pryor & Lockhart and others No. 2 Moran, NW SW NW section 4-18-10w, in the Stumps area, Rice County, produced 746 bbls. of oil on potential test. It had Siliceous lime at 3,246-71 feet, total depth. Gulf Oil Corp. No. 6 Steckel, NW cor. section 31-19-10w, on the Rice County side of the Silica pool, pumped 864 bbls. of oil in 14 hours, from Siliceous lime at 3,282-3,303 feet, total depth. Slick, Pryor & Lockhart No. 2 Mezger, NW NE NE section 21-20-10w, made a potential of 849 bbls. in 24 hours. Top of Siliceous lime was 3,351 feet; total depth, 3,354 feet. In the Chase area, Lario Oil & Gas Co. No. 4 Foote, SE SW NE section 7-20-9w, topped Siliceous at 3,252 feet; total depth 3,280 feet. It was acidized, and pumped 1,000 bbls. of oil in 20 hours.

Gulf Oil Corp. No. 3 Wendel, C E half SE NE section 36-19-11w, in the Barton County sector of the Silica pool, topped Siliceous lime at 3,282 feet; total depth 3,303 feet; pumped 212 bbls. of oil in 24 hours; was acidized and pumped 687 bbls. of oil in 14 hours.

Stafford County

One new location was announced in the Richardson area of Stafford County. It was the Stanolind Oil & Gas Co. No. 3 Komarek, SE NW SE section 30-22-11w.

Ellis County

The only well completed in Ellis County was the Gulf Oil Corp. No. 1 Swires, SE SE SW section 8-15-18w, producing from Oswald lime topped at 3,260 feet; total depth, 3,294 feet. It pumped 170 bbls. of oil, with a showing of water, in 24 hours; was acidized, and made 24-hour potential of 976 bbls. of oil.

Rush County

No wells were completed in Rush County, but work was started at three wildcat locations. Rose Spring Drilling Co. and others No. 1 Jacobs, SW SE NW section 8-16-17w, wildcat northeast of Liebenthal in the northern part of the county, was rigging up rotary. National Refining Co. was building rig for No. 1 Werth, NW NE NE section 7-16-18w, wildcat northwest of Liebenthal; and Boyle & Grossman No. 1 Wilson, NE cor. section 33-17-19w, wildcat south of Hargrove in the western part of the county, was rigging up.

Pratt County

Lario Oil & Gas Co. and others No. 1 Lemon Community, SE SE NW section 12-29-13w, wildcat north of Sawyer in southern Pratt County, was dry and abandoned at 4,728 feet, total depth. Tops were, Chat, 4,363 feet; Viola lime, 4,514 feet; Simpson, 4,606 feet; Siliceous lime, 4,699 feet, with water showing.

Skelly Oil Co. and others were building rig for No. 3 Maxedon, C N half S half NE section 25-27-11w.

Ellsworth County

Carter Oil Co. and others No. 4 Teubner C-39, C NW section 26-17-9w, in the Lorraine area of Ellsworth County, made a 24-hour potential of 1,072 bbls .of oil, and was completed. Siliceous lime, the producing horizon, was topped at 3,170 feet; total depth, 3,176 feet.

Fred Jones was moving in material for No. 1 Byers, SW SW NW section 18-17-10w, the only new test starting in the county.

Carter Oil Co. and others No. 2 Meichert, NE NW SE section 23-17-9w, in the Lorraine area, topped Siliceous lime at 3,211½ feet; total depth 3,213 feet, and made a potential of 133 bbls. of oil, with 130 bbls. of water, in 24 hours. Phillips Petroleum Co. No. 6 Meichert, SW SE NE section 23-17-9w, made potential of 363 bbls. of oil in 24 hours after topping Siliceous lime at 3,201 feet, 3,210 feet total depth.

McPherson County

Two new tests in McPherson County were reported. Marathon Oil Co. No. 1 Decker, SW SE SE section 20-21-1w, was drilling at 310 feet. Continental Oil Co. and others No. 1 Huntsman, SE SE NW section 29-21-1w, was a location.

Continental Oil Co. and others No. 1 Hetzke, SW SW NE section 29-21-1w, in the Graber area, swabbed 187 bbls. of oil in two and one-half hours at 3,291 feet, and was drilling below 3,302 feet with a hole full of oil; Hunton lime was topped at 3,284 feet.

Harvey County

Sinclair Prairie Oil Co. No. 5 Ediger, SW SE SW section 19-22-3w, in the Hollow-Nikkel area of Harvey County, old total depth 3,525 feet, was deepened to Siliceous lime at 3,572-78 feet, new total depth. It swabbed 130 bbls. of oil in 12 hours and made 24-hour potential of 321 bbls. of oil, with 20 bbls. of water. It was the only completion in Harvey County.

The only new work reported in Harvey County was the Sinclair Prairie Oil Co. No. 5 Martens, SW NE SE section 19-22-3w, an old well bottomed at 3,548 feet, underreaming 6-inch casing to drill deeper.

Sedgwick County

Material was being moved in for a new wildcat test west of Wichita in Sedgwick County. It is the Dickey Oil Co. No. 1 Ayers, SW SW NW section 12-27-2.

Sumner County

Only one well was completed and two new tests reported in Sumner County. Sinclair Prairie Oil Co. No. 5 Kamis, C N half N half SW section 28-31-1w, in the Wellington area, was the sole completion. Top of chat was 3,661 feet; total depth, 3,698 feet. It was acidized and made potential of 251 bbls. of oil.

New work in Sumner County: E. F. Jones No. 1 Green, SE SE SE section 11-32-2, rig; Carpenter and others No. 1 Reece, NE NE NE section 14-32-2, drilling at 755 feet.

Cowley County

Roth & Faurot completed their No. 1 Sherwood, NE NW SW section 11-31-4, wildcat in northwestern Cowley County, as a Bartlesville sand producer. It topped sand at 3,007 feet; total depth, 3,031 feet; was shot with 40 quarts, and made 24-hour potential of 215 bbls. of oil.

Largest Cowley County completion of the week was the Lloyd, Frost & Study No. 2 Weathered, SE SW SE section 28-31-3. It made 24-hour potential of 1,625 bbls. of oil from Siliceous lime topped at 3,326 feet; total depth, 3,335 feet. Alma Petroleum Co. No. 3 Gregory, NW SE SE section 6-35-3, had sand at 3,475-3,510 feet, total depth; swabbed 10 bbls. of oil and 10 bbls. of water in 24 hours; was treated with acid, and later pumped 15 bbls. of oil in 24 hours, and was completed. Same operator's No. 2 Finch, SE SW NE section 7-35-3, had sand at 3,475-3,502 feet, total depth, pumped 90 bbls. of oil in 24 hours and was completed.

One new test was started, Gralapp & Loony No. 1 Rockwell, SE SE NE section 13-32-4, moving in material.

Butler County

Phillips Petroleum Co. No. 15 Scully, SW SW NE section 17-23-4, in the Elbing area, Butler County, made a potential of 312 bbls. of oil and was completed. Top of Kansas City lime was at 1,906 feet; total depth, 2,045 feet; plugged back to 2,039 feet; pumped 182 bbls. of oil and 50 bbls. of water in the first 24 hours, and was acidized before taking potential test. Western Kansas Oil & Refining Co. No. 1-A Lucas, NE NE SE section 10-28-6, in the Kramer area, had a hole full of water at 3,052 feet, total depth, and was dry and abandoned. Siliceous lime was topped at 3,049 feet.

Ponds were being dug for Perdew and others No. 1 Sandberg, SW NW NE section 11-28-6, the only new Butler County test.

In the Kramer area of Butler County, Eldorado Refining Co. and Skelly Oil Co. No. 1 Gilson, SE SE NE section 10-28-6, had Viola lime at 3,001-3,012 feet; pay at 3,028-31 feet, total depth; pumped 91 bbls. of oil and 4 bbls. of water in first 24 hours, and 110 bbls. of oil and 1 bbls. of water in the next 24 hours. It was acidized, but had not been tested.

Greenwood County

In Greenwood County, two abandonments were reported and no new tests were started. Rockwell and others deepened No. 1 Kulander, NW NE NE section 33-23-13, from 650 feet to Mississippi lime at 1,680-88 feet, total depth, produced 3 bbls. of water and was dry and abandoned. Ward McGinnis No. 2 Scott, NE SE NW section 18-24-12, had a hole full of water in Mississippi lime at 1,803-50 feet, total depth, and was dry and abandoned.

Woodson County

Shaffer & Howell No. 1 Haas, SE cor. 22-23-14, the sole Woodson County completion, pumped 15 bbls. of oil in 24 hours after acidizing and was completed; top of Mississippi lime was 1,611 feet; total depth, 1,621 feet.

Braden and others No. 1 Sage, NE NE SE section 36-23-13, the only new Woodson County test, was drilling below 1,335 feet.

Haskell County

Work was getting started at a new wildcat in Haskell County, in the southwestern part of the state. Kuhn Brothers and others No. 1 Nilson, SW SW SE section 21-28-32w, northeast of Santa Fe, was a rotary rig.

First Aid Contests at Houston Oil Show

The first aid contests will be extended this year over the entire week of the Oil Equipment and Engineering Exposition at Convention Hall in Houston, Tex., April 20 to 25. This series of contests will be conducted under the "Demonstration Rules: U. S. Bureau of Mines Handbook" (1930 edition) and the "American Petroleum Institute Revised Contest Outline." Contesting companies will draw lot for dates and problems.

Elimination contests are being held by the leading companies first aid teams. Approximately five teams will compete each day. Entries have been made by United Gas Co., Jackson, Miss.; Magnolia Petroleum Co., Beaumont, Tex.; Texas Co., refining and pipe line divisions; two teams of Shell Co. refinery; three teams from Humble Oil & Refining Co., one each from the refining, producing and pipe line divisions; Empire Oil & Refining Co. at Gladewater, Tex., and the Louisiana Oil & Refining Co. at Shreveport, La.

Twenty problems will be furnished each team. Each team will work four problems, including artificial respiration.

Four prize cups will be issued, three for efficiency, and the fourth E. D. Bullard Co. for artificial respiration.

Michigan Field Report

By

PAUL A. ELLIOTT

WELL IN DUCK LAKE STARTS AT 2,000 BARRELS PER DAY

MUSKEGON, Mich., Mar. 16.—Michigan's first "marine" oil well, a 2,000-bbl. gusher in the Dundee limestone, was brought in Saturday beneath the bed of Duck Lake in the Crystal field.

Duck Lake Oil Co., of Muskegon, completed the well with the largest initial flow of any recent test in the Montcalm County field, central Michigan. Dundee was topped at 3,167 feet.

Started last fall, necessitating construction of levees and an island about 200 feet off the shore of the small inland lake, No. 1 fee is located NE NE SW section 11-10n-5w, Crystal Township. It is about a mile south of the Durbin discovery well, brought in March 28, 1935, with a daily initial of about 5,000 bbls.

The Duck Lake well made about 80 bbls. an hour to start, but was pinched back to about 60 bbls. an hour to guard against water encroachment, which has recently become a serious problem in the Crystal field.

Howard Owen and R. L. Pattison, formerly of Chatham, Ontario, where they were in the natural gas business, are officers of the Duck Lake Oil Co. Prior to entering the Crystal field last fall they had operated a natural gas pipe line serving several major Muskegon industries from wells in the Muskegon field. They also drilled several small oil wells at Muskegon.

Old Dutch Refining Co., of Muskegon, had laid a 3-inch pipe line to the new well before it was brought in as success had been indicated by several wells of 600 to 1,000 bbls. south of the lake, a body of water about a mile in diameter. Old Dutch planned to start running oil to a crude truck loading platform Saturday afternoon, moving it overland from there to the Muskegon plant.

The Duck Lake company took out three permits for additional wells on a 60-acre lease several months ago and is expected to start a second test immediately. A dozen other permits for wells to be drilled under water also have been taken out since success was indicated by structures in the first well. Several concerns are preparing to drill as rapidly as derricks can be erected and tools moved in.

Crystal Field

The only other completions in the Cystal field were two acid-treated wells previously drilled into the Dundee. Mammoth Petroleum & Refining Corp. No. 1-C William Strait, SW NE SE section 3-11n-5w, Ferris Township, last week made 20 to 25 bbls. daily after treatment. Dundee was topped at 3,202 feet and drilling completed at 3,209 feet.

Daily Crude Oil Co. No. 1 E. J. Fulford, SW NW SW section 36, same township, was rated a 275-bbl. well after treatment in Dundee topped at 3,216 feet and drilled about 6 feet in.

Another test to be treated was Strange & Fortney No. 2 Alva Rockelman, NE SW SE section 11, Crystal Township, plugging back from 3,199 to 3,197 feet to shut off water encountered in the Dundee which was topped at 3,195 feet. The well showed gas in the pay sands.

Gordon Oil Co. also was testing its No. 8 William Strait, NW NE NW section 3, Crystal, where a second charge of acid may be necessary to make production at a total depth of 3,202 feet.

T. F. Caldwell, Inc., was expected to make a decision whether to produce or abandon No. 1 W. H. Pugsley, SW SE NW section 36, Ferris. The Dundee showed oil and gas at 3,207 feet but the hole was drilled into bottom water at 3,214 feet. It was deepened to test the Monroe but showed water after setting pipe at 3,286 feet. Casing was pulled and the hole drilled to about 3,300 feet. The well flowed 12,500,000 feet of gas when the drill passed through the Michigan Stray sands at about 900 feet.

Another test nearing completion was Mammoth Corp. No. 1 Albert Conner, SE SE NE section 27, Ferris Township, casing at 3,196 feet with a string of 5-inch.

Midland County

Four Midland County completions, three in Jasper Township and one in Porter, added about 1,500 bbls. initial to the state's lessened output.

Pure Oil Co. completed the two large wells in Jasper with one drilled in by the Gratiot Oil & Gas Co. Pure made the other completion in Porter.

Pure Oil Co. No. 1 J. P. Balch, C S SW SE section 2-13n-2w, Jasper, increased from 171 bbls. to 557 bbls. daily after acid treatment at a total depth of 3,441 feet. Pure No. 1 Reno and William Root, C N NW SW, same section, flowed 627 bbls. daily after acid at 3,447 feet, total depth.

The Gratiot Co. No. 1 Ruby Greene, SW NE NE section 13, Jasper, was estimated a 25-bbl. initial producer. Pure No. 7-A Iva Bond, NE NW NE section 18-13n-1w, Porter Township, completed at 3,428 feet for 120 bbls. daily, after treatment. Pure also was preparing to treat its No. 3-B J. H. Miller, NW NE NE, same section.

Ogemaw County

Weber Oil Co. cased its No. 3 Boeing estate, SW SW SE section 36-22n-2e, West Branch Township, Ogemaw County, at 2,468 feet.

New success in section 36 led to a decision by the Youman-Dalton Oil Co. to pull casing and deepen its No. 2 E. Hustead, NW NW SE, producing from the Traverse for more than a year. It will be drilled to the Dundee.

Two other Ogemaw tests were nearing completion, namely Mills Oil, Inc., No. 1 Jaqua, NW NE SW section 6-21n-3e, Mills Township, and Morris-Barnes Oil & Gas Syndicate No. 4 Golf Course, SW NE SW section 20, West Branch. The former was completing and the latter drilling at 2,650 feet.

Saginaw County

Smith Petroleum Co., of Saginaw, last week reported another small Berea well in the Birch Run Township field, Saginaw County. It was the No. 1 William J. Smith, SE NE NW section 20-10n-6e, which topped the shallow producing formation at 1,524.5 feet and will be given a shot of nitro after being drilled 21 feet in. It was good for 7 bbls. a day naturally.

Wildcat Tests

Three wildcat tests were reported dry, one testing a show in the Trenton formation and another nearing possible pay in widely scattered areas in central and southeastern Michigan. Another in western Michigan also had reset casing to shut off water which drowned out a Dundee show.

Goll, Graves & Mechling, Inc., plugged and abandoned their No. 1 M. Kent, NE NW SE section 28-17n-1e, Billing Township, Gladwin County, near the Beaverton play, when the Marshall was topped too low at 1,300 feet and the Red Rock at about 1,400 feet. It was drilled 8 miles east and about 2 miles south of the Beaverton field.

Smith Petroleum Co. drilled another "duster" for Tuscola County when the No. 1 Frances M. McComb, NW SW SE section 31-10n-8e, Millington Township, was abandoned at 340 feet for the same reason, formations running low.

A gas test failed in Sumner Township, Gratiot County, when V. H. Arbaugh abandoned his No. 1 William S. and Libbie Gould, SW SW SE section 34-11n-4w.

Testing Shows

Socony-Vacuum Oil Co. was still testing its No. 1 McCarberry in Lenawee County, shut down at 2,552 feet, or 102 feet in the Trenton formation in a south central Michigan wildcat.

The Wittmer Co. No. 1 S. H. Kimball, SE SW SE section 15-7n-5w, Lyons Township, Ionia County, also was reported nearing the Dundee casing point at more than 2,600 feet though exact information was withheld.

Max Pray No. 1 Victor Berothy, SW SE NW section 29-17n-15w, a Logan Township, Mason County, test about 50 miles north of the Muskegon field, had reset casing successfully shutting off water and was reported drilling in the Dundee where a show of oil had been encountered several weeks ago at 2,479 feet. Completion was delayed by snow and winter weather.

New Wildcat Play

The latest new play in Michigan is in Taymouth Township, Saginaw County, where one test was drilling last week at more than 1,700 feet and two other locations have been made.

Mid-State Development Co. No. 1 A. J. Burleson, SE SW SE section 21-10n-5e, is the drilling well located about 12 miles southeast of the old Saginaw Township field and 4 to 6 miles due west of the Birch Run field.

Two new locations in the township include T. F. Caldwell, Inc., No. 1 Henry McDonagh, NW NW SW section 19, and James H. Hibbard No. 1 J. Woodward in section 22.

Within a radius of 15 miles east, west and south, nine wildcat projects have been started or projected.

Michigan Gas & Oil Corp. joined the current semiwildcat play in Montcalm County, where three other operators already have started tests in Evergreen, one township west of Crystal-Montcalm. The new location is the No. 1 F. Youngs, NE NW SW section 1-9n-6w, Bushnell Township, near Jetter and Lima Oil Co. Vickeryville discovery well.

Two new Arenac County wildcats also were placed under permit, one in Arenac Township by the Arenac Oil Co., Inc., of Detroit and the other by the Red-Man Oil Co., of Alma. The former is the No. 1 Frank J. Griffin, SW SW NW section 1-19n-5e, and the latter the No. 1 J. Kahayde, SW SW SE section 9-20n-3e, Moffitt Township.

Another wildcat included in the last permit list is Jerome Nadell No. 1 Edgar B. Olds estate, NW NE SE section 35-9n-8e, Forrest Township, Genessee County.

New locations, principally in the proven fields, included: Melling Oil & Gas Co. No. 7 State, SE NE NW section 6-21n-3e, Mills Township, Ogemaw County; Refiners Petroleum Corp. No. 1 Carl and Aurelia Mauterstock, C SW SE section 11-12n-7w, a Belvidere Township, Montcalm County, gas test; McClanahan Oil Co. No. 2 Frank Lamphier, SE SW NE section 2-10n-5w, Crystal-Montcalm oil test; William E. Vass, trustee, No. 1 J. C. DeSpelder, NW SW SW section 23-10n-8w, a wildcat in Montcalm Township and County; New Haven Oil & Gas Co., Inc., No. 1 Benjamin Shaver, C NE NW section 4-10n-4w, a New Haven Township, Gratiot County, gas test, and Smith Petroleum Co.'s latest test in the Birch Run Township field, Saginaw County, the No. 4-A Frank M. and Agnes C. Morse, NE SE NW section 20-10n-6e.

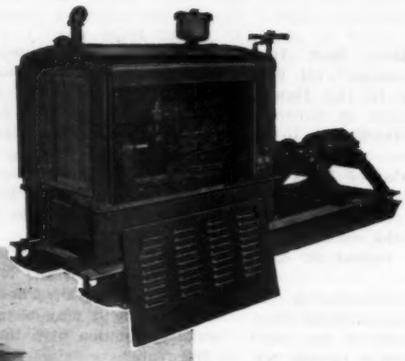
Stork Oil Co. also is planning a

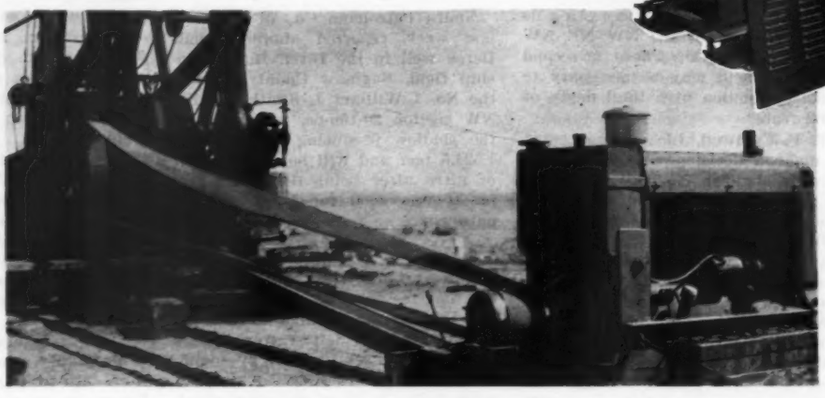
(Continued on Page 180)

Read the record

Performance . . . the Test of *Any* Diesel

The Cummins-Diesel stands on its "Records of Performance"—its outstanding economy in time and money for all drilling operations. Only 1.83 gallons of fuel per hour on cable tools. One quart of water per day per engine. Compare this with your cost for *any* other kind of power.





Above: **The Cummins-Diesel Model HP-602.** ***Left:*** **The Cummins-Diesel owned by W. & E. Production Co., operating a Super-J Fort Worth Spudder four days, deepening well from 2205 ft. to 2255 ft.**

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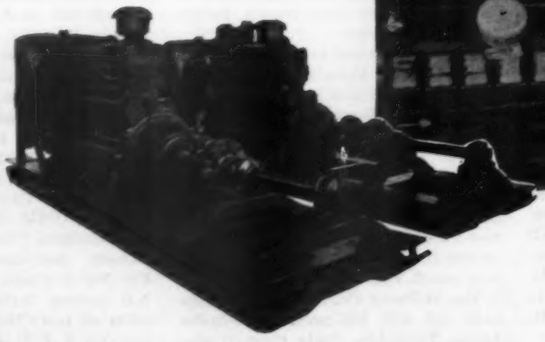
The Mid-Continent Supply Company will have a full line of Cummins-Diesels on exhibition together with Allis-Chalmers drilling rigs.



Above: **Noble Drilling Company's two 200 h. p. *cold starting* Cummins-Diesels on a rotary drilling rig. Now drilling the sixth well north of Seminole. A duplicate rig also owned by Noble has just started a deep hole test south of Wilson in Carter County.** ***Left:*** **Two Cummins-Diesel Models L-P-602.**

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CUMMINS-DIESELS

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East and East Central Texas

By
L. E. BREDBERG

TITUS COUNTY WELL LOOKS LIKE COMMERCIAL PRODUCER

DALLAS, Tex., Mar. 16.—The Titus County test of Peveto and others near the town of Talco appears to be good for a commercial producer at its last reported depth of 4,208 feet and the C. W. Windsor test about 2½ miles southwest of the Peveto and others well was showing oil.

Peveto and others' discovery well swabbed from 10 to 15 bbls. per hour, 95 per cent oil, with the remainder wash water. There was no gas. If, when the water is entirely swabbed from the hole, the well does not show better than at present, it may be drilled deeper. No one knows just how much sand has been cored in the test, but 6 inches were recovered from a 2-foot core taken from 4,206 feet to the total depth. A better saturated streak may be cored if the well is carried deeper.

The C. W. Windsor test on the Hughes & King lands, in the Orlando James Survey, southwest of Talco and southwest of the discovery well, made a drill stem test at 4,145 feet, but failed. Another such test was made at 4,164 feet, through 1⅜-inch choke on top and 2-inch choke on the bottom. It was opened for 28 minutes showing 350 feet of mud with a slight show of oil. It is now coring deeper, believed not to be deep enough for the heaviest production. It showed spotted saturation from 4,157 feet to total depth of 4,180 feet with top of the Paluxy sand picked at 4,152 feet. Best saturation was found in 2 feet between 4,178-80 feet.

Railroads and Highways

Several Woodbine sand tests have been drilled in the area, three near the town of Talco, but all failed to make producers. However, the geological information gained from their drilling, was no doubt of inestimable value when the Paluxy sand showed for production in the Talco discovery.

If a field of importance is uncovered in the Talco area, Mount Pleasant will probably be made headquarters for the field by the majority of operators and companies. It is composed of some 3,500 people, has paved streets and walks, fine homes and good hotels although the latter are comparatively small, and has all city conveniences.

Two More Tests for Talco

Locations were staked in the Talco area in northwestern Titus County for two more tests, and one old location was abandoned. Jule Alford of Dallas, as trustee, is to drill a Paluxy sand test on the W. D. Fry lands in the I. P. Stern Survey. This location falls about 1½ miles south of the Talco discovery well. Derrick is up on the location.

O'Neal, Trustee, is to drill on the O. C. Lillianstern 80-acre tract in the William Cann Survey, 4 miles southeast of the Talco discovery well and derrick is up on this location. Both tests are in Titus County. The location of S. Rotondi on the Lillianstern farm in the J. Bodt Survey, about 5 miles southeast of Talco, has been abandoned. The new location no doubt displaces that test and will be of more interest because it is at least 1 mile nearer the Talco well.

Other tests are scheduled, especially along the fault zone and on blocks assembled and now being assembled in the sector. Brokers and operators and company men are staying at Mt. Pleasant, Mt. Vernon, Sulphur Springs and Greenville while taking leases, blocking acreage and watching the outcome of the Talco discovery and the two tests drilling nearby, the Humble Oil & Refining Co. No. 1 M. B. Groves, in the Ben Jones Survey, about 2 miles due east of the Peveto and others No. 1 Carr, now being down around 3,000 feet and perhaps ready to make drill stem test within another week or 10 days.

Other Wildcat Locations

W. A. Reiter and others are building a derrick for a test on the T. W. Bounds lands in the H.T.&B. Survey near Wortham in Navarro County. Another location was staked in the county by Coffield and Guthrie on the L. Lovett farm in the John Harris Survey, in the Powell field, the operators now rigging up.

A. McCutchin and others are drilling an interesting test east of the gas area in the south end of the East Texas field in Rusk County, and are below 2,700 feet. It is located on the I. B. Moyers farm in the R. Laubam Survey. Pure Oil Co. is moving in material for its 8,500-foot Trinity sand test south of Concord and in the Mt. Enterprise area in south Rusk County. The Pure location is on the W. H. Faulkner lands in the William Elliott Survey. This is one of the "hottest" spots in the East Texas district at the present time, with operators and companies spreading out from the Pure block to purchase protection, and acreage for trading.

Two wildcat tests were abandoned in the district this week, one in Lamar County and the other in Morris County. The former was drilled by Childs and others on the J. M. Johnson farm 1 miles west of Deport. It was given up at a total depth of 3,014 feet. Elevation is 467 feet. The dry hole in Morris was put down by Watson and others on the Hall lands in the L. Jordan Survey, about 5 miles northeast of Dangerfield. Total depth was 4,280 feet, with an elevation of 360 feet.

A dry hole was abandoned on the north end of the Van Field in Van Zandt County, J. C. Stoddard No. 2 Magers, total depth 2,930 feet. Location is in the Nacogdoches County School Lands Survey, in the Nacatoch sand producing strip north of the main part of the field.

Trinity Sand Test

C. F. Lytle No. 1 Thompson, Trinity sand test in the Pedro Varella Survey, in the old Mexia field area, Limestone County, is now drilling around 5,000 feet with the operators withholding all information on the test, which is located on the Balcones Fault.

East Texas Field

The Cordova Union Oil Co. of Eprt Worth and the American Liberty Oil Co. of Dallas have been negotiating on the sale and purchase of the former's three-quarters interest in three leases comprised of a total of 133 acres on which 10 wells are located. The leases are as follows: Christian "D" lease, 62.5 acres, with eight pumping wells and one drilling, in the Daniel Clark Survey; Christian "C" lease, 35.1 acres in Elliott Survey, with five flowing wells; and Christian "A" lease, 35.4 acres with nine flowing wells, in the Robert E. Wynne Survey, all in Gregg County. The American Liberty Oil Co. is now building an 8-inch connecting line from Conroe to Rusk Station to tie into a line which takes oil out of the East Texas field. Such a purchase by the company, as the above, would help insure an additional supply of

Afternoon tour crew on Titus County discovery. Top row, left to right: J. G. Rogers, "Slatts" Davis and Mike Langley, driller. Bottom row—A. R. Burch and Ross Turner

Morning tour crew on the Titus County discovery, left to right (top)—Bob Bolton, driller; Ross Smith and Alvin Kasselbaum. Bottom row—Joe Fullilove and Bob Fox

oil for that independently owned line. The American Liberty Oil Co. is one of the largest independent producing companies in the East Texas field.

EAST TEXAS COMPLETIONS

Completions in the East Texas and East Central Texas fields reported in the past week, with their top of sand and total depth records and initial production, were as follows:

Gregg County

Arkansas Fuel Oil Co. No. 5 Clements, 3,620-3,647 feet, 26 bbls. in 15 minutes; No. 3 Davis, 3,589-3,592 feet, 17 bbls. in 15 minutes. Gulf Oil Corp. No. 16 Snyder, 3,490-3,520 feet, 48 bbls. per hour. Humble Oil & Refining Co. No. 40 Hughes, 3,624-3,635 feet, 47 bbls. per hour.

L.G.S. Oil Co. No. 4 McQueen, 3,564-3,600 feet, 15 bbls. in 30 minutes. Merritt Drilling Co. No. 1 Farrell, 3,603-3,650 feet, shot with 40 quarts, dry and abandoned. Selby & Lewis No. 10 Ingram, 3,555-3,587 feet, 42 bbls. in 30 minutes. Simms and Stanolind Oil & Gas Co. No. 41-B Flewellen, 3,671-3,684 feet, 10 bbls. in 10 minutes.

Tide Water Oil Co. No. 19 Castleberry, 3,604-3,613 feet, 11 bbls. in 10 minutes; No. 16 Shepherd, 3,644-3,666 feet, 15 bbls. in 10 minutes. Arcadia Refining Co. No. 6 Jeffry, 3,765-3,766 feet, 20 bbls. per hour. Arkansas Fuel Oil Co. No. 33 Hughey & Ross, 3,519-3,544 feet, 22 bbls. in 15 minutes.

Gulf Oil Corp. No. 8 Clayton, 3,571-3,598 feet, 20 bbls. in 25 minutes. Russell I. Lacy, 3,471-3,497 feet, 20 bbls. per hour on pump. Schulman No. 1 Kilgore City, 3,496-3,504 feet, 20 bbls. in 30 minutes. Shell Petroleum Corp. No. 33 Elder, 3,540-3,560 feet, 40 bbls. in 30 minutes.

Sinclair Prairie Oil Co. No. 30 Andrews, 3,463-3,492 feet, 17 bbls. in 15 minutes; No. 52-A King, 3,459-3,500 feet, 25 bbls. in 15 minutes. Tide Water Oil Co. 29 Bivens, 3,637-3,645 feet, 10 bbls. in 10 minutes; No. 17 Strong, 3,655-3,665 feet, 10 bbls. in 10 minutes.

Cherokee County

Texas-Canadian Oil Co. No. 2-A Kelley, 3,681-3,682 feet, 60 bbls. per hour.

Rusk County

Atlantic Oil Producing Co. No. 6 Arnold, 3,629-3,725 feet, 60 bbls. per hour; No. 9 Arnold, 3,620-3,694 feet, 40 bbls. per hour. Barbare No. 3 Propes, 3,524-3,564 feet, 65 bbls. per day on pump. Chalk & Slaughter No. 3-B Frederick, 3,540-3,588 feet, 10 bbls. per hour on pump. Humble Oil & Refining Co. No. 17 Glover, 3,735-3,796 feet, 60 bbls. per hour; No. 41-B Plowman, 3,664-3,708 feet, 50 bbls. per hour.

Marathon Oil Co. No. 31 Moore, 3,603-3,688 feet, 11 bbls. in 15 minutes. Octo Oil Co. No. 2-C Frederick, 3,560-3,587 feet, 10 bbls. in two hours on pump. Retsal Drilling Co. No. 19 Maxwell, 3,565-3,632 feet, 10 bbls. per hour on pump; No. 20 Maxwell, 3,589-3,651 feet, 10 bbls. per hour on pump.

Tide Water Oil Co. No. 14 Shaw, 3,687-3,740 feet, 15 bbls. in 15 minutes. Union Oil Co. No. 1 Frederick, 3,550-3,640 feet, 35 bbls. per day on pump. Constantine Refining Co. No. 5 Mayfield, 3,625-3,655 feet, 20 bbls. in four hours on pump.

Humble Oil & Refining Co. No. 16-A Laird, 3,586-3,620 feet, 100 bbls. per hour; No. 17-A Sexton, 3,640-3,739 feet, 29 bbls. per hour.

Hurtle Oil Co. No. 2 Dickerson, 3,521-3,578 feet, 20 bbls. in four hours on pump. Tide Water Oil Co. No. 12 Bean, 3,554-3,602 feet, 10 bbls. in 10 minutes.

Smith County

Merrick and others No. 1 Cole, 3,868-3,869 feet, 25 bbls. in 30 minutes. Sinclair Prairie Oil Co. No. 16-A Mayfield, 3,776-3,782 feet, 30 bbls. in 30 minutes. Sun Oil Co. No. 5-A Pace, 3,676-3,681 feet, 35 bbls. per hour. Texas-Canadian Oil Co. No. 7 Pace, 3,795-3,796 feet, 80 bbls. per hour. Trentman Oil Co. No. 3 Moore, 3,837-3,839 feet, 40 bbls. in 30 minutes.

Upshur County

Davis, receiver, No. 2 Florence, 3,775-3,776 feet, 25 bbls. per day on pump. Fields No. 8 Walker, 3,701-3,779 feet, plugged back to 3,705 feet, 15 bbls. in 35 minutes through three-eighths-inch choke. Manziel No. 2 Mackey, 3,746-3,749 feet, 24 bbls. per hour. Rutledge & Boller No. 3 Todd, 3,752-3,754 feet, 27 bbls. per hour. Stedham & Thrasher No. 12 O'Byrne, 3,758-3,762 feet, 10 bbls. in 30 minutes on pump. Sun Oil Co. No. 1 Mackey, 3,697-3,698 feet, 45 bbls. per hour. Wadley No. 4 Gillespie, 3,724-3,776 feet, dry and abandoned.

Lamar County

Childs and others No. 1 J. M. Johnson, dry and abandoned, 3,014 feet; elevation 467 feet; 1 miles west of Deport.

Morris County

Watson and others No. 1 Hall, dry and abandoned 4,280 feet; elevation 360 feet; 5 miles north of Dangerfield.

Van Zandt County

Stoddard and others No. 2 Magers, dry and abandoned 2,930 feet.

Gulf Coast Fields

(Continued from Page 174)

bottom. This extends the field approximately a half mile to the east. No. 5-B Cobb is expected to extend the field about 950 feet west when it is tested at a total depth of 7,503 feet. Both wells are located in the M. Cummings Survey, and will be tested through perforated casing.

To the southeast in the new South Bay City field, Hamman Exploration Co. No. 1 Cleveland, the discovery well completed last week at 9,439 feet is flowing 288 bbls. of fluid per day through a three-sixteenths inch choke, of which 22 per cent is salt water. The tubing pressure is 1,340 pounds and the casing pressure 2,400 pounds. The well is located in the E. Hall Survey and it opens the third 9,000-foot productive horizon for the Gulf Coast.

Placedo Extended

Another important extension was made for the Placedo field, Victoria County, when Barnsdall Oil Co. No. 2 W. R. Smith tested 5,000 feet of pipe line oil on a drill stem test from 6,027-35 feet, the total depth. Seven-inch casing is being run to the top of the sand and it will be given a production test during the week. It is the most southeasterly well, being located 1,000 feet southeast of the company's No. 1 Smith which is producing from the 4,700-foot sand. The same company's No. 1 J. S. Wheless located in the J. M. Bronson Survey was completed for one of the largest producers, when it flowed 25 bbls. per hour through a quarter-inch choke with tubing pressure of 450 pounds and casing pressure 500 pounds. Production is from sand cored from 4,756-65 feet, the total depth.

Failure in Garwood

Sterling Oil & Refining Co. has abandoned No. 2-B Powell, in a sidetracked hole at 5,928 feet. It is located in the Garwood area, southern Colorado County, has encountered several encouraging showings but failed to produce commercially. In the east half of the county, about 4 miles northeast of the town of Ramsey, G. W. Johnson has derrick up for No. 1 Drymolle, located 330 feet from the southwest line and 330 feet from the southeast line in the T. Coleman Survey.

LOUISIANA

At the Hayes prospect, southern Jefferson Davis Parish, La., Shell Petroleum Corp. No. 1 Lacassine, located in section 20-11s-5w is fishing for stuck drill stem at 6,034 feet, which became stuck when the well attempted to blow out while the operators were coring at 9,802 feet. The pressure is reported to have built up to 3,000 pounds and the well flowed salt water and mud for several minutes before being shut in. This is the third showing encountered below 7,000 feet, and it is being watched with much interest.

The fifth test to reach the 10,000-foot horizon on the Gulf Coast was marked off the list as a failure when Shell Petroleum Corp. quit its No. 1 Realty Operators at 10,155 feet. The well is located on the Houma prospect in the northeastern part of Terrebonne Parish.

Prospects of the two producing areas at the Gillis field, Calcasieu Parish, being linked together does not appear so encouraging due to Fohs Oil Co. No. 1 Frost testing salt water after being cored 3 feet deeper to a total depth of 5,272 feet. It was originally tested at 5,269 feet and made 500,000 feet of gas. The well is located midway between the two areas which are producing from 6,600 feet and 7,000 feet. In the English Bayou area, Fohs Oil Co. No. 10 Castle topped oil sand at 7,022 feet, and was completed at 7,065 feet for an initial production of 575 bbls. per day through a quarter-inch choke with tubing pressure 900 pounds and casing pressure 450 pounds. Location is in section 14-9s-8w. To the north, Union Sulphur Co. No. 5 Powell Lumber Co. cored oil sand from 6,660-75 feet and flowed 587 bbls. per day through a quarter-inch choke with tubing pressure 1,250 pounds.

On the South Lake Charles Prospect, Calcasieu Parish, Union Sulphur Co. has abandoned No. 2 Prairie Farm Land & Canal Co. after coring salt water sand in a sidetracked hole from 5,555-66 feet. It was originally drilled to 9,250 feet and was plugged back, sidetracked and redrilled to its present depth after an electrical coring test had been run to 7,028 feet. This is the second 9,000-foot test drilled on this block within the past months.

Deep Test Abandoned

Another interesting deep test which was abandoned the past week was Magnolia Petroleum Co. No. 1 Miami Corp., located on the Willow Lake Prospect, about 4 miles southeast of the Big Lake field in Cameron Parish which was quit at 8,490 feet.

At the Bayou Bouillon dome, St. Martin Parish, Southern Oil Co. No. 1 State topped sand showing oil at 3,120 feet and 7-inch casing has been cemented at 3,120 feet after an electrical coring test showed 11 ohms resistivity. The hole is bottomed at 3,130 feet and if productive, it will be the first producer to be completed in this field within the past year. Location is in section 13-9s-8w.

In the southwestern part of Acadia Parish, near the town of Estherwood, Magnolia Petroleum Co. is moving in a rig for a wildcat test to be drilled on a block of approximately 6,500 acres centering around Township 10s-1w. Considerable leasing has been done in the area with Stanolind Oil & Gas Co. and Gulf Oil Corp. being the principal companies' holding the majority of the protection acreage.

Preparations are being made by Continental Oil Co. to complete No. 1 Ardoin located in the Tepetate field, Acadia Parish. The gas sand was topped at 8,234 feet, oil sand at 8,298 feet and the hole is bottomed at 8,319 feet with 5¾-inch casing cemented on bottom. It is to be tested through perforated casing from 8,217-72 feet. Location is in section 28-7s-2w.

Michigan Fields

(Continued from Page 177)

new wildcat test on the Zimmer lease, E NW section 34, Grout Township, Gladwin County, 18n-2w, where Sun Oil Co. holds considerable acreage and has drilled several unsuccessful tests.

Associated Petroleum Co., which recently completed a dry hole in Keene Township, Ionia County, is reported planning a wildcat test in Courtland Township, Kent County, Township 9n-10e, northeast of Grand Rapids, on a 6,000-acre tract.

Pure Oil Co. No. 1 Mitchell-Keeler, NW NW NW section 10-14n-6w, the Broomfield Township, Isabella County, discovery gasser which came in for 8,300,000 feet daily in the Michigan Stray sands February 14, 1930, will be deepened to the Dundee as an oil test. About 50 gas wells have been drilled in the field during the past six years. A show of oil was found in a previous Pure test in section 4, about a mile northwest of the new deepening project.

Old Timers Memorial at Tulsa Expo

Pioneers who helped build the $14,000,000,000 petroleum industry will be honored at the ninth International Petroleum Exposition in Tulsa May 16 to 23, according to President W. G. Skelly, who announces that Victor F. Barnett, of the Tulsa Tribune, has been selected as chairman of the "Old Timers" committee.

A monument is being constructed and will contain a plaque which will be dedicated to the pioneers of the industry. A special chamber in the monument will contain a book in which names of pioneers will be registered and sealed between expositions. Medals will be awarded old timers who are selected as "Grand Old Man of the Petroleum Industry" and "Grand Old Man of Tulsa."

The exposition asks old timers to write to Mr. Barnett in care of the exposition, listing their experience in the oil industry and the first job they held in it. Individuals wishing to nominate old timers may also send in names.

Rocky Mountain Area

By
T. R. INGRAM

RESUMPTION OF ACTIVITY IN NORTH; SOUTH FIELDS BUSY

DENVER, Colo., Mar. 16.—The South Park Oil Co. No. 1 State, a wildcat in south central Colorado, has an important show of gas on top of what is believed to be the Hygiene. The Trojan Oil & Gas Co.'s test to the Mississippian near Lamar, was plugged and abandoned. Another test is scheduled to be drilled to the north of the Lamar well.

The Ohio Oil Co. completed a 450-bbl. well on the Byron Dome, Big Horn County, Wyo., in its No. 1 Charlotte Lindsay. The General Petroleum Corp. No. 1 Whitford, Overland Dome, Carbon County, a wildcat, was plugged and abandoned and another test will be drilled to the southeast. The Osage field in Weston County has thawed out and resumed with one small completion.

Seven locations were made the past week in the Cut Bank field in Montana. One well was dry and abandoned in that field and one producer was completed in the Kevin-Sunburst pool.

NEW MEXICO

The Amerada Petroleum Corp. No. 1 State "L", C SW NW section 20-19-37, Lea County, N. Mex., was the largest of two completions of the week in the Monument area. After acidizing, it flowed 1,536 bbls. of oil in 24 hours, gas gauging 259,000 feet. Before being treated with 4,000 gallons of acid, it swabbed 12 bbls. of oil in six hours. Oil pay was found at 3,898 to 3,996 feet, total depth. The other Monument completion was the Gulf Oil Corp. No. 1 Weir, C NE NE section 35-19-36, which was acidized with 3,000 gallons and flowed 83 bbls. of oil and 5 bbls. of water in 12 hours through tubing, was acidized a second time with 3,000 gallons and flowed 135 bbls. of oil in 24 hours, cutting 7 per cent water. Gas gauged 1,500,000 feet. Oil pay was had at 3,960-78 feet, total depth.

Only one well was completed in the Eunice area, Lea County, Gulf Oil Corp. No. 1 Janda "B," C NW SE section 32-21-36, had oil pay at 3,855-3,909 feet, total depth, and flowed 936 bbls. of oil natural through tubing in 24 hours, and produced 995,000 feet of gas.

Amon G. Carter and associates had the sole completion in the Cooper area, Lea County, at No. 1 M. A. Hair, C SW NW section 11-24-37. At total depth of 3,760 feet, in oil pay topped at 3,630 feet, it was shot with 140 quarts and completed, pumping 45 bbls. of oil in 24 hours.

In the Sims, or Eunice sand area, Lea County, Skelly Oil Co. No. 1 J. V. Baker, C SE SW section 22-22-37, had oil pay at 3,542-90 feet, total depth, and was completed. It produced 211 bbls. of oil through tubing choke and 3,000,000 feet of gas in 24 hours. Same operators No. 1 Steeler, C NW NE section 17-23-37, was bottomed at 3,810 feet, plugged back to 3,758 feet, produced 2,800,000 feet of gas and was completed. Gas sand was encountered at 3,497-3,513 feet.

Texas Pacific Coal & Oil Co. No. 1 State, Account No. 2, C SE SW section 9-22-36, Lea County, old well deepened from 3,835 to 3,874 feet, plugged back 1 foot to complete. It flowed 400 bbls. of oil through tubing in 24 hours, natural. Oil pay was found at 3,812-73 feet.

Three wells in Eddy County were completed. Barnsdall Oil Co. No. 3 Dodd, C SE NE section 22-17-29, pumped 168 bbls. of oil in the first 24 hours after a shot and acidizing. It had oil pay at 2,710-60 feet; total depth, 2,836 feet, and plugged back to 2,760 feet. R. D. Compton No. 8 Brainard, SW SE SE SE section 5-18-27, had oil pay at 1,256-58 feet, total depth, pumped 20 bbls. of oil in 24 hours and was completed. Flint & Berry No. 1 Berry, C SE SW section 24-17-27, was dry and abandoned at 490 feet, total depth. It had several shows of dead oil from 370 to 471 feet.

Eunice Area

Continental Oil Co. No. 6 4-B Meyer, C S half SE NW sec. 4-21-36. T.D. 2,580 ft.; set 7⅝-in. csg.

Continental Oil Co. No. 7 4-B Meyer, C NW SE sec. 4-21-36. Bldg. rig.

Continental Oil Co. No. 8 4-B Meyer, C SW NE sec. 4-21-36. T.D. 317 ft.; set 10-in. csg.

Gulf Oil Corp. No. 7 Bell-Ramsey-State, C SW NW sec. 4-21-36. T.D. 4,217 ft.; P.B. 3,890 ft.

Gulf Oil Corp. No. 8 Bell-Ramsey-State, C NW NW sec. 4-21-36. Cellar and pits.

Devonian Oil Co. No. 3 State-Heasley, C NE NE sec. 5-21-36. Drlg. 2,218 ft.

Gulf Oil Corp. No. 4 Orcutt, C NE NW sec. 5-21-36. Drlg. 3,891 ft.

Gulf Oil Corp. No. 5 Orcutt, C SW SE sec. 5-21-36. T.D. 3,862 ft.; fishing.

Gulf Oil Corp. No. 6 Orcutt, C NE NE sec. 5-21-36. Rig.

Gulf Oil Corp. No. 1 Graham-State "E," C SW SE NE sec. 6-21-36. Drlg. 3,620 ft.

Amerada Pet. Corp. No. 3 Houston, C NW NE sec. 7-21-36, east offset of No. 94 lease. T.D. 3,895 ft.; prep. to swab.

Humble O. & R. Co. No. 3 Adkins, C NE SW sec. 10-21-36. Rig.

Humble O. & R. Co. No. 1 J. D. Knox, C NW SE sec. 10-21-36. Drlg. 3,226 ft.

Gulf Oil Corp. No. 1 H. C. Collins, C SE NW sec. 14-21-36. T.D. 3,707 ft.; set 5½-in. csg.

Gulf Oil Corp. No. 1 East-Bell-State, C NW NW sec. 15-21-36. T.D. 3,828 ft.; set 5½-in. csg.

Gulf Oil Corp No. 2 East-Bell, C SW NW sec. 15-21-36. Rig.

Tide Water Oil Co. No. 2 State "D", C SW SE sec. 16-21-36. Drlg. 3,182 ft.

Tide Water Oil Co. No. 3 State "D", C NE SE sec. 16-21-36. T.D. 1,575 ft.; set 7⅝-in. csg.

Continental Oil Co. No. 4 18-A Lockhart, C SW SW sec. 18-21-36. Drlg. 3,831 ft.

Continental Oil Co. No. 1 18-B Meyer, C SE NW sec. 18-21-36. T.D. 3,942 ft.; flowed 156 bbls. in 1¼ hrs.

Continental Oil Co. No. 4 18-A Meyer, C SW NE sec. 18-21-36. Location.

Gulf Oil Corp. No. 5 Arnott-Ramsey "C", C SE SW sec. 21-21-36. Drlg. 2,900 ft.

Gulf Oil Corp. No. 6 Arnott-Ramsey "C", C NE NW sec. 21-21-36. Rigging up rotary.

Continental Oil Co. No. 3 28-B Lockhart, C NW SW sec. 28-21-36. T.D. 2,954 ft.; set 7⅝-in. csg.

Continental Oil Co. No. 4 28-B Lockhart, C SW SW sec. 28-21-36. Drlg. 3,646 ft.

Continental Oil Co. No. 5 28-B Lockhart, C NW NE sec. 28-21-36. Drlg. 300 ft.

Empire G. & F. Co. No. 2 Felton, C SE NW sec. 28-21-36. T.D. 1,660 ft.; set 9⅝-in. csg.

Humble O. & R. Co. No. 8 State "B", C SE SE sec. 28-21-36. T.D. 3,909 ft.; testing.

Humble O. & R. Co. No. 9 State "B", C NE SW sec. 29-21-36. Rig.

Continental Oil Co. No. 2 30-A Lockhart, C NE NE sec. 30-21-36. T.D. 3,983 ft.; testing.

Empire G. & F. Co. No. 4 State "D", C SE NE sec. 32-21-36, five-eighths mile N part of No. 157 lease. Drlg. 3,640 ft.

General Crude Oil Co. No. 1 State, C NW SW sec. 32-21-36, one-half mile NW part No. 157 lease. T.D. 3,974 ft.; 3,500 ft. fluid in hole.

Empire O. & R. Co. No. 5 State "D", C NE NW sec. 32-21-36. Cellar and pits.

Gulf Oil Corp. No. 2 Janda "B", C NE SE sec. 32-21-36. Location.

Gulf Oil Corp. No. 1 Arnott-Ramsey "D", C NW NW sec. 33-21-36. Drlg. 3,216 ft.

Barnsdall Oil Co. et al No. 1 Hardy, C SE NE sec. 29-21-37. Drlg. 3,555 ft.

The Texas Co. No. 1 State "H", C SE SE sec. 31-20-37, west offset No. 196 lease. Spudded.

Shell Pet. Corp. No. 1 State-Endura "D", C SE NW sec. 11-21-35. Drlg. 2,274 ft.

Shell Pet. Corp. No. 1 State "H", C SE SE sec. 13-21-35. Drlg. 3,155 ft.

Ohio Area

Ohio Oil Co. No. 1 State-Maxwell, C NE NW sec. 16-22-36. T.D. 3,896 ft.; flowed 30 bbls. per hour; testing.

Ohio Oil Co. No. 4 State-McDonald, C SE SE sec. 16-22-36. T.D. 3,920 ft.; flowed 70 bbls. oil and 10 bbls. water in 24 hrs. on gas lift.

Shell-Devonian No. 1 Christmas, C NE NE sec. 21-22-36. Drlg. 975 ft.

Gulf Oil Corp. No. 1 A. L. Christmas, SE SE SE sec. 27-22-36. T.D. 4,310 ft.; to plug back to 3,625 ft.

Sims Area

Samedan Oil Co. No. 1 Parks, 330 ft. from S and 400 ft. from W lines, SW¼ sec. 14-22-37. Drlg. 360 ft.

Continental Oil Co. No. 1-22-A Elliott, C SW SW sec. 22-22-37. Cellar and pits.

Skelly Oil Co. No. 1 King "B," C SW SE sec. 32-22-37. T.D. 3,657 ft.; fishing.

Skelly Oil Co. No. 1 Ella Simms, C SW NE sec. 3-23-37. Location.

Skelly Oil Co. No. 1 A. L. King, C SE NW sec. 4-23-37. T.D. 3,450 ft.; set 7-in. csg.

Skelly Oil Co. No. 1 R. R. Simms, C SE SE sec. 4-23-37. T.D. 3,669 ft.; flowed 79 bbls. in 24 hours.

Hobbs Area

Shell Pet. Corp. No. 1 State "E," C E half SE SE sec. 14-18-37. T.D. 4,374 ft.; P.B. 4,178 ft.

Sun Oil Co. No. 1 McKinley, SW SW NE sec. 20-18-38. T.D. 4,242 ft.; flowed 36 bbls. in 24 hours; to pump.

Gulf Oil Corp. No. 4 Grimes, SW SW NE SW sec. 21-18-38. Rigging up rotary.

Gulf Oil Corp. No. 1 Steve Taylor, C SE NE sec. 24-18-38. T.D. 4,883 ft.; P.B. 4,587 ft.

J. P. Cusack No. 2 Moon "B," SW cor. NE sec. 28-18-38. T.D. 227 ft.; R.U.R.

Monument Area

Texas Co. No. 2 Saunders, C SW SE sec. 18-19-37. Rig.

Gulf Oil Corp. No. 4 Culp, C SW NE sec. 19-19-37. Drlg. 3,088 ft.

Gulf Oil Corp. No. 5 Culp, C SE NE sec. 19-19-37. Drlg. 1,978 ft.

Gulf Oil Corp. No. 1 Graham-State "D," C SW SE sec. 19-19-37. T.D. 4,163 ft.; P.B. 3,983 ft.

Shell Pet. Corp. No. 1 State "D," C NW SE sec. 19-19-37. T.D. 4,033 ft.; preparing to test.

Texas Co. No. 1 State "G," C SE SW sec. 19-19-37. T.D. 3,787 ft.; fishing.

Texas Co. No. 2 State "G," C SW SW sec. 19-19-37. Drlg. 3,782 ft.

Oilwell Drlg. Co. No. 1 State"A," C SW NE sec. 29-19-37. Rig.

Gulf Oil Corp. No. 1 Luthy, C SW NW sec. 29-19-37. Rigging up rotary.

Amerada Pet. Corp. No. 1 State "O," C NW NE sec. 30-19-37. Location.

Continental Oil Co. No. 1-30-C State, C NE NW sec. 30-19-37. Bldg. rig.

Continental Oil Co. No. 2-30-C State, C NW NW sec. 30-19-37. Rigging up.

Ohio Oil Co. No. 1 State-Elliott, C NW SE sec. 30-19-37. Drlg. 2,817 ft.

Amerada Pet. Corp. No. 1 Culp, SW SW SE sec. 31-19-37. Rigging up.

Anderson & Prichard Oil Corp. No. 1 Britt "A," C SE SW sec. 6-20-37. T.D. 269 ft.; set 13-in. csg.

Texas Co. No. 1 Phillips, NW NW NW sec. 6-20-37. Drlg. 3,460 ft.

Anderson & Prichard No. 2 Britt, C NE NW sec. 7-20-37, ¾ mile W of Barber lease. T.D. 3,826 ft.; set 7-in. csg.

Gulf Oil Corp. No. 2 Graham-State "C," C NW NE sec. 24-19-36. Drlg. 3,411 ft.

Texas Co. No. 2 State "F," C SE SE sec. 24-19-36. Drlg. 3,402 ft.

Amerada Pet. No. 1 Weir "A," C NW SW sec. 25-19-36. T.D. 3,824 ft.; drlg. plug.

Skelly Oil Co. No. 1 Christmas, C SW SW sec. 25-19-36. Drlg. 2,897 ft.

Gulf Oil Corp. No. 1 Graham-State "E," SE SE SE sec. 36-19-36. Drlg. 3,370 ft.

Amerada Pet. Corp. No. 3 Weir, C NW SW sec. 35-19-36. Bldg. rig.

Shell Pet. Corp. No. 2 State "B," C NW NW sec. 36-19-36. Cellar.

Amerada Pet. Corp. No. 1 Phillips, NE NE NE SW sec. 1-20-36. Drlg. 3,800 ft.

Amerada Pet. Corp. No. 1 State "M," C SE NW sec. 2-20-36. T.D. 3,808 ft.; set 7-in. csg.

Amerada Pet. Corp. No. 2 Weir, C NW NW sec. 2-20-36. Drlg. 2,693 ft.

Barnsdall Oil Co. No. 4 Cooper, C SE NE sec. 2-20-36. Drlg. 3,226 ft.

Amerada Pet. Corp. No. 3 State "J," C NE SW sec. 2-20-36. Location.

Continental Oil Co. No. 1 3-A J. L. Reed, C NE NE sec. 3-20-36. Cellar and pits.

Cooper Area

Republic Prod. Co. No. 1 Davis, C SW SW sec. 34-23-36. S.D. indefinitely.

General Crude Oil Co. No. 1 State "F", C SW SW sec. 2-24-36. T.D. 3,590 ft.; swabbing.

Gulf Oil Corp. No. 2 J. M. Cooper, C NW SE sec. 14-24-36. T.D. 3,698 ft.; P.B. 3,550 ft.; packer set 3,460 ft.; est. 15,000,000 ft. gas.

Liberty Oil & Drlg. Co. No. 1 J. W. Hair, C SW SE sec. 24-24-37. Drlg. 415 ft.

Plains Prod. Co. No. 1 R. L. Mosley, C NW SE sec. 34-24-37. T.D. 1,300 ft.; setting 8¼-in. csg.

Lea County—Miscellaneous

Culbertson-Irwin & Stovall No. 1 J. B. Humphrey, C SE SW sec. 3-25-37. Drlg. 1,540 ft.

Plains Prod. Co. No. 1 George Smith, C SE SE sec. 4-25-37. Drlg. 960 ft.

Culbertson-Irwin & Stovall No. 1 J. A. Stuart, C SW SE sec. 10-25-37. Drlg. 1,785 ft.

Harry Leonard No. 1 Justice, SW NW NW sec. 20-25-37. T.D. 3,501 ft.; P.B. 2,970 ft.; to make gasser.

Harry Leonard No. 1 Leonard-Lanhart, C SW NE sec. 21-25-37 (on Humble acreage). Drlg. 2,625 ft.

Texas Co. and Repollo Oil Co. No. 1 Lanchart, C NE sec. 29-25-37. Rig.

Stanolind O. & G. No. 29 Cyrus Farnsworth, C SW NW sec. 18-26-37. T.D. 3,060 ft.; P.B. 3,050 ft.

W. L. Todd et al No. 1 Lemon Permit, C NW SW sec. 17-21-32. Drlg. 3,660 ft.

Maljamar O. & G. No. 6 Baisch, C NW SE sec. 21-17-32. Drlg. 3,270 ft.

Eddy County

Etz Bros. No. 2 State, C NW SW NE sec. 16-17-30. Drlg. 1,400 ft.

Ohio Oil Co. No. 1 State-McCullough, SE SW SW sec. 16-17-30. Drlg. 2,485 ft.

Premier Pet. Corp. No. 2 Dexter "B", NW SW NE sec. 20-17-30. Drlg. 925 ft.

Emperor Oil Co. No. 2 Puckett, C NW NE sec. 24-17-31. T.D. 3,933 ft.; flowed 100 bbls. dly. through tubing.

Tignor, Etz & Keys No. 1 Keys "B", sec. 3-17-28. Drlg. 285 ft.

Red Lake Oil Co. No. 6 State, NE NE SW sec. 22-17-28. Location.

D. & B. Oil Co. No. 1 Jenkins, NW SW NW sec. 20-17-30. T.D. 3,258 ft.; testing; est. 200 bbls. oil dly.

Dexter & Berry No. 1 Berry, NW NE NW sec. 21-17-30. Rigging up machine.

F. W. & Y. Oil Co. No. 72 State, NE NW NE sec. 10-19-28. Drlg. 1,665 ft.

Dooley & Dixon No. 1 Commerce, C W½ NW NW sec. 18-20-27. Drlg. 398 ft.

Tex Pattillo No. 2 Thomason, NE cor. sec. 1-20-28. Drlg. 600 ft.

Chaves County

Tannehill No. 2 Campbell, C NE SE sec. 1-11-25. S.D. 875 ft. in lime.

NORTHWEST NEW MEXICO

Bernalillo County

Norine Realty Co., Inc., No. 2 Gallegas grant, SE NW NW sec. 19-11n-4e. Drlg. 1,200 ft. in sand and gravel.

Harding County

Khaay et al No. 1 De Baca, C sec. 19-20n-31e. Running 8¼-in. at 847 ft.; 10-in. at 250 ft.

McKinley County

Seward et al No. 1 State, NE SE NE sec. 2-19n-9w. Drlg. 518 ft.

Seward et al No. 1 fee, C NW SE sec. 35-20n-9w. S.D. 130 ft. in shale.

Dave Stacey No. 1 State, NE NE SW sec. 21-20n-9w. R.U. machine (first report).

Forth & Hickerson No. 2 Santa Fe, NE NW NE sec. 20-20-9w. Drlg. 400 ft.

Foster & Clark No. 1 Railroad Land, NE NE NW sec. 29-20n-9w. Rigging up spudder (first report).

Montrose O. & G. Co. No. 1 State, NE NE sec. 28-20n-9w. Rigging up spudder (first report).

Montrose O. & G. Co. No. 1 State, NE NE sec. 28-20n-9w. T.D. 570 ft.; missed shallow sand; may plug.

Quay County

Quay County Dev. Co. No. 1 Wallace, SW SW SE sec. 19-9n-32e. S.D. 816 ft.; rainbows at 814 ft.; show of S.W. at 775 ft.

Rio Arriba County

El Vado Structure Properties Co., Ltd., No. 1 Tierra Amarilla grant, NE sec. 26-3s-1e (unsurveyed).

San Juan County

The Continental Oil Co. No. 51 Tribal, C NW NE section 2-29-19w, Rattlesnake field, flowed 29 bbls. first 24 hours at a total depth of 725 feet. The 7-inch was set at 681 feet.

Jack Amenda No. 3, SW NW SW sec. 25-30n-12w. S.D. 920 ft. for orders.

Jack Amenda No. 4 fee, NW NE SW sec. 25-30n-12w. Drlg. 420 ft. in shale.

J. D. Cross et al No. 1 Wilson, SW SW SE sec. 17-30-11w. S.D. 810 ft.

Cross & Pool No. 1 Aztec, sec. 1-30-11w. Making water shutoff at 740 ft.

Nick Spatter No. 1 fee, C NE SW sec. 32-31-11w. Running 6⅝-in. at 1,780 ft.

Southern Union Gas Co. No. 5 Government, C NE NE sec. 14-28n-11w. T.D. 1,869 ft.; drlg. plug.

Southern Union Gas Co. No. 6 Government, C NW NW sec. 19-28n-10w. Location (first report).

Torrance County

45 Pet. Co. No. 1 Greenfield, C NW SW sec. 17-9-8e. Drlg. 1,450 ft. in hard lime.

Bruce Frazier No. 1 Frazier, SE sec. 12-2n-31e. Drlg. 1,210 ft. in granite wash; water at 882-84 ft.

COLORADO

Adams County

Glenridge Oil Corp. No. 1 Hills, SE SE NE sec. 27-3s-64. T.D. 4,415 ft.; cmtd. caves; W.O.C.

Riddle Pet. Co. No. 1 Baxter, C SW sec. 2-3s-6w. S.D. 700 ft. for drill pipe.

Archuleta County

Wm. E. Hughes Est. No. 4 fee (unsurveyed), CSL SE SE sec. 24-32n-2e. Drlg. 600 ft.

Wm. E. Hughes Est. No. 5 Gramps, SE NW SE sec. 24-32n-2e (unsurveyed). Drlg. 160 ft.

Oil City Pet. Co. No. 1-A Garnett, NW NE NW sec. 25-32n-2e. S.D. 1,515 ft.; top Dakota series 1,415.

Oil City Pet. Co. and Archuleta O. & G. Co. No. 1 Reeder, Lot 5 (SW SE SW) sec. 24-32n-2e. Spudding at 40 ft. (cor. location).

H. L. Hendrick No. 1 Crowley (unsurveyed), sec. 2-32-1e. S.D. 710 ft. after pulling pipe to S.R.

Baca County

Paul Robb et al No. 1, NW NW NW sec. 24-32-48w. Derrick and pit, and water well rig.

Boulder County

Leslie R. Steel et al No. 1 Maxwell, SW NE NW sec. 24-1n-71e. T.D. 2,420 ft.; P.B. to 1,460 ft. to test oil show in Muddy.

Cheyenne County

Brittel Oil Co., Inc., No. 1 Steip, C NE NW sec. 26-12s-47w. Rigged and ready to spud.

Jefferson County

Rainbow Oil Co. No. 1 Johnson, NE sec. 26-4s-68. Derrick.

Ruby Hill O. & G. Co. No. 1 Braden, SE cor. sec. 24-4s-69. Drlg. 4,415 ft.

La Plata County

McGarr Pet. Co. No. 1 Pinton Mesa, CSL NE NE sec. 24-35n-12w. S.D. 1,300 ft. for 10-in.

Lincoln County

Consolidated Smelting & Metals Co. No. 1 Hancock, NE NE sec. 7-17s-52. Drlg. 1,920 ft.

Morgan County

Swisher et al No. 1 Lunt, 92 ft. W of E line and 360 ft. N of S line, sec. 3-4n-60. Drlg. 1,300 ft. and lowering pipe.

Mesa County

Ohio Oil Co. No. 1 Robertson, C SW SW sec. 7-6n-97w. Location.

Texas Co. No. 7 Knowlton, NE cor. Lot 8, sec. 10-4n-91w. Drlg. 4,430 ft.

Montezuma County

McElmo Oil Co. No. 1 West, NE NW NE sec. 21-36n-17w. Contracted with Perry Coon to complete; T.D. 3,705 ft.; preparing to drill by tools.

Park County

The South Park Oil Co. No. 1 State, in the Hartsel district, is making enough gas from a streak of sand at 3,900 feet to lift the tools and throw a kink into the drilling line. The horizon is believed to be the top of the Hygiene in the Pierre shale. The 6¼-inch will be underreamed to bottom and set before making new hole. This test is making enough gas between the 10 and 8¼i-nch to fire one boiler and enough between the 6¼ and 8¼-inch to fire another. This is a wildcat in the southern part of South Park where federal and state governments are planning one of the largest migratory game bird reserves in the country. If the plan goes through it will not have any bearing on the oil operations. C. E. Shoenfelt, petroleum engineer of Denver, spotted the test and is supervising drilling operations.

South Park Oil Co. No. 1 State, SE NE SW sec. 16-11s-75w. T.D. 3,990 ft.; U.R. 6¼-in.

Prowers County

The Trojan Oil & Gas Co. No. 1 Lotus Oil, NW NE NE section 15-23-46, Lamar district, an important wildcat which began drilling early in 1933, is reported plugged and abandoned after drilling to a total depth of 5,890 feet. It plugged back and tested an oil show at around 3,400 feet in the Kansas City lime, but was unable to shut off water. Top of the Cherokee was at 4,200 feet. It entered the Mississippian at somewhere between 5,000 and 5,021 feet.

Another test probably will be drilled in Prowers County this spring to the north of the Lamar well. Negotiations for a joint test on the Cottonwood structure in Townships 21 and 22s, Ranges 44 and 45w, are reported nearing conclusion. The Continental Oil Co. has a block of 18,000 acres. The Texas Co., the Magnolia Petroleum Corp., the California Co., the Gulf Oil Corp. and the Indian Territory Illuminating Oil Co. have acreage. The Indian Territory company core-drilled the area and the Continental company made a detailed seismograph survey with definite surface structure features.

Routt County

Mid-Colo. Pet. Co. No. 1 Omoholt, NE SE SE sec. 29-4n-87w. S.D. 2,860 ft. on account of weather.

WYOMING

Albany County

California Co. No. 3 Hoist, 1,650 ft. W of E line and 970 ft. N of S line, sec. 18-17n-77w. Drlg. 3,048 ft.

Big Horn County

The Ohio Oil Co. No. 1 Charlotte Lindsay, SW SW NE section 23-56-97, on the Byron dome, was completed at 5,184 feet and swabbed 450 bbls. initial from the Embar-Tensleep topped at 4,980 feet. It is rigging up for pump test. The 7-inch was cemented at 4,990 feet. The elevation is 4,044 feet. This is the highest structural elevation of any well drilled in the field.

J. W. Bales No. 1 Parker, C SW SW sec. 23-4-89. S.D. 690 ft. for pipe.

Peter Evanhoff et al No. 1 McAllister, Lot 4, NW NE SE sec. 35n-87w. S.D. 2,250 ft.

Kinney-Coastal Oil Co. No. 3 Government, SW NW NE sec. 24-56n-98w. T.D. 4,335 ft.; making considerable gas and spraying oil; running packer to shut off upper gas.

Ohio Oil Co. No. 4 Byron Union, SW SW NE sec. 32-56-97. Coring at 5,630 ft.

Montana-Wyoming Oil Co. No. 1 Allen, 270 ft. from N line, 930 ft. from E line, Lot 52 (SE NW SE) sec. 32-56n-97w. T.D. 3,825 ft.; running 9⅝-in. preparatory to killing gas.

Peay Oil Co. No. 1 Denio, Tract 43-C, sec. 15-55n-97w. T.D. 3,890 ft.; will try to go to Tensleep.

J. H. Shaffer No. 1 Keachie, C SW SW sec. 5-49-61. T.D. 1,450 ft.; sidetracking tools at 1,366 ft.

W. O. Taylor et al No. 1 Hoskins, Lot 5 (SE SE) sec. 25-56n-97w. T.D. 5,275 ft.; drill pipe parted, 2,220 ft. in hole; fishing.

Campbell County

G. J. Sherin et al No. 1 Rhodes, NE SE S sec. 24-49n-74w. Derrick up, sump and reservoir completed (cor. loc.).

Carbon County

The General Petroleum Corp. of California is abandoning its No. 1 Whitford. SW SE SE section 24-20-84, on the Overland, or Pass Creek structure. It was drilled to 4,383 feet by Earl W. Reeder, Inc., at which depth it was taken over last summer by General Petroleum Corp. and deepened to 6,482 feet where it tested the Sundance. The ...g white sand at 6,349-6,435 feet was dry and the upper Sundance tested water. The hole then was plugged back testing all horizons up to and including the General Petroleum series at 3,690 feet. This test was located nearly half a mile west of same company's No. 1 Union Pacific, which is standing at 5,931 feet. The latter had some good shows of oil. Another test will be drilled 4 miles to the southeast of No. 1 Whitford.

General Pet. Corp. No. 1 Union Pacific, SW NW sec. 5-19n-83w. Bldg. road.

Ohio Oil Co. and California Co. No. 1 Union Pacific, Acct. J, NE SW NW sec. 25-21-79w. T.D. 5,478 ft.; cmtd. 5 3/16-in. liner at 5,351 ft.

Ohio Oil Co. and California Oil Co. No. 2 Union Pacific, C NE NE sec. 35-21n-79w. Cellar.

Ohio Oil Co. No. 1 State, SE NW NE sec. 34-20n-78w. T.D. 2,650 ft.; old well drilled deeper from Dakota to Sundance; (first report).

Ohio Oil Co. No. 8 Harrison & Cooper, CWL W½ SW sec. 35-20-78w. T.D. 3,374 ft.; ran and cmtd. 4¾-in. liner at 2,704-3,318 ft.; R.U. pump.

Ohio Oil Co. No. 1 State, SE SE NE sec. 34-20n-78w. T.D. 2,894 ft. in Dakota; O.W.D.D. to Sundance; R.U.R.

Union Oil Co. of California and Mutual Oil Synd. No. 1 Union Pacific, 1,890 ft. from E line and 1,320 ft. from S line, sec. 1-18-78w. S.D. 4,400 ft. (cor.)

Converse County

John Ackert No. 1 Daniels, SW SW NE sec. 17-32-71. S.D. 4,004 ft.

Hot Springs County

California Exploration Co. No. 2 Government, NW SW NW, sec. 4-44-96. T.D. 4,245 ft.; running 6⅛-in. to set on top Tensleep.

Ohio Oil Co. No. 73 Mill Iron Cattle Co., NE SW SE sec. 19-46n-95w. Cellar.

Stanolind O. & G. Co. No. 29 State-Ridgely, SE NE SE sec. 19-46n-95w. Lost core in crevice at 3,217 ft.; cmtd.; W.O.C.

Lincoln County

Senrab Oil Corp. No. 3 Government, CSL SE NW sec. 10-26n-113w. S.D. 1,020 ft.

Natrona County

Empire State Oil Co. No. 15, NW SE NE sec. 11-33n-83w. Drlg. 419 ft.

Niobrara County

The Continental Oil Co., which is constructing an absorption gasoline plant on the Rohlff lease in the west end of the Lance Creek field at a cost of $100,000, is preparing to lay a gasoline line from the plant to railhead at Manville, a distance of 19.8 miles. It will consist of 2-inch welded line and will parallel the 4-inch oil line which the company recently put into operation. Work will start about April 1 and the cost will be approximately $36,000.

Argo Oil Co. No. 7 Elliott, C NE NW sec. 5-35n-65w. Spudding.

Argo Oil Co. No. 6 Elliott, C SE NW sec. 5-35n-65w. Drlg. 2,960 ft.; prep. to core.

Black Hills Ref. Co. No. 1 Mills Est., C SW NW sec. 27-36n-64w. Spudded and S.D. account of weather.

J. H. Huber Co. No. 1 Jones, NE SE NW sec. 6-26n-65w. T.D. 4,096 ft.; P.B. to 4,032 ft.; running 2-in. tubing and R.U. for pump test.

Ohio Oil Co. No. 8 Agnes Rohlff, C SE NE sec. 32-36n-65w. Rigging.

Ohio Oil Co. No. 5 Converse Sheep, C SE SW sec. 32-36n-65w. Set 12½-in. at 220 ft. with 95 sacks.

Ohio Oil Co. No. 3 Richards & Comstock, C NE SW sec. 32-36n-65w. R.U.R.

S. & H. Dev. Co. No. 1-A Olinger, SE NE NW sec. 1-36-63. T.D. 1,674 ft.; S.O. Dakota water with 4¾-in. at 1,620 ft.; fishing for tools; 600 ft. of oil in hole from Lakota at 1,666-74 ft.

Sheridan County

Beaver Creek Oil Co. No. 1 Allison, SW SE sec. 15-55n-85w. Drlg. 3,050 ft. and carrying 4½-in.

Uinta County

Intermountain Pet. Corp. of Utah No. 1 Union Pacific-Hayes, SW NW SW sec. 24-19n-118w. Drlg. 1,575 ft.

W. D. Marshall No. 1 Government, NW SW SE sec. 12-15n-118w. S.D. 1,260 ft.

Washakie County

Ariton & Doyle No. 1 Government, SW SW SE sec. 29-48-91w. S.D. 1,115 ft.

Wyoming O. & R. Co. No. 2 Government, SW SW SW sec. 31-48-90. T.D. 1,404 ft. (cor.); fishing for tools.

Weston County

The Osage field has thawed out and roads have dried sufficiently so operations are about back to normal. One completion was reported in E. H. Wiltse No. 8, CNL NW NE section 17-46-63, which is pumping 5 bbls. from shale at a total depth of 273 feet.

Henry Egert No. 2, SW NE SE sec. 8-46n-63. Feeling for sand below 200 ft. with show of oil.

Conway Oil Corp. No. 1, SE SE NE sec. 7-41n-60. Fishing for tools at 2,087 ft.

MONTANA

Big Horn County

Daniels Pet. Co. No. 1 May, C SE SE sec. 13-1s-33e. S.D. 3,000 ft. after setting 6¼-in. at 2,895 ft. and drilling plug.

Fallon County

Montana-Dakota Utilities Co. No. 1, NE NW sec. 17-3n-62e. S.D. 6,349 ft.; weather.

Fergus County

Minnesota Co. No. 1 Fenholt, SE NW SW sec. 24-21n-18e (cor.). S.D. after setting 12½-in. at 125 ft.

Judith Operation Co. No. 1 Government, C SW SW sec. 26-22n-17e. S.D. 1,052 ft. (cor.).

Kalispel-Kevin Oil Co. No. 2 Emmons, C SW SE sec. 20-21-18e. Drlg. 556 ft.

Glacier County

Favorable weather conditions are resulting in a resumption of operations in the Cut Bank field and seven new locations were reported with one completion. The Montana Power Gas Co. No. 1 Simero, C SE SE section 30-34-5w, half a mile west of a gas well and a mile northeast of a group of producers, was plugged and abandoned at a total depth of 2,767 feet. The Sunburst at 2,695-2,715 feet had a show of oil and the Cut Bank at 2,720-57 feet had a show at 2,747 feet. It tested 1 bbl. after standing 12 hours.

A. B. Cobb No. 5 Walberger, C NE NE sec. 35-36n-6w. Rig.

Cobb-Pardee No. 1 Stufft, C SE NW sec. 25-36n-6w. S.D. 732 ft.

Cobb-Reagan No. 1 Jackson, NE NW NW sec. 5-32n-5w. Drlg. 2,625 ft.

A. E. Crumley No. 1 Tribal, C SW NE sec. 31-33n-5w. Loc. (first report).

Gardner et al No. 1 Cole, C NE SW sec. 2-32n-6w. S.D. 250 ft.

Goodman Oil Co. No. 1 Tribal, SW NW SW sec. 25-33n-6w. M.I.M. (first report).

L. P. Jackson et al No. 1 Tribal, NW SE NW sec. 23-34n-7w. Ready to spud.

R. C. Jeffries No. 4 Lukens, NE NE NE sec. 12-33n-6w. S.D. 2,610 ft.

Kincheloe-Hanlon No. 1 State, SE SE SE sec. 25-33n-6w. Drlg. 2,400 ft.

Jack Marshall No. 1 Tribal, 140 ft. S of N line and 200 ft. E of W line, Lot 7, sec. 7-32n-5w. T.D. 2,915 ft.; fishing for liner.

Montana Power Gas Co. No. 1 Eisler, 900 ft. WE line and 1,980 ft. NS line sec. 5-33n-5w. Cellar (first report).

Montana Power Gas Co. No. 2 Coburn, C NW NE sec. 8-33n-5w. Rig (first report).

Nadeau Bros. No. 1 Tribal, C Lot 4, sec. 6-32n-5w. T.D. 2,845 ft.; fishing for tools.

Par Oil Co. No. 6 Haines, NE SW NE sec. 2-34n-6w. Rigging (first report).

Santa Rita O. & G. Co. No. 6 Tribal, 660 ft. S of C W line, sec. 15-35n-6w. Drlg. 1,440 ft.; Colo. at 550 ft.

Santa Rita O. & G. Co. No. 7 Shearon, 660 ft. S of N line and 349 ft. W of E line, sec. 24-36n-6w. Drlg. 2,500 ft.

Santa Rita O. & G. Co. No. 1 Corey, NE NW SE sec. 5-32n-5w. S.D. 2,959 ft. for spudder.

(Continued on Page 189)

California Field Report

HIGHER PRICES MAY EXTEND TO THREE MORE OIL FIELDS

By
L. P. STOCKMAN

LOS ANGELES, Calif., Mar. 16.—State production of crude oil has not shown much change during the past 15 days despite attempts to curtail production to the prescribed allowable of 537,000 bbls. per day, and the failure to make any further headway during the past fortnight tends to indicate that maximum effectiveness has been attained. All fields in the state with the exception of Alamitos Heights, Dominguez, Elk Hills, Ventura Avenue and the Lakeview section of the Midway-Sunset field have received price increases for either having attained their respective objectives or shown substantial reductions in production as a reward for cooperative effort and the future price to be paid for crude oil purchased in the five excepted districts depends upon the action of producers in curtailing production.

Operators in the Dominguez field of Los Angeles basin have reduced crude oil production from 31,000 bbls. per day to 25,500 bbls. daily and it appears likely that this district will be given an increased price in the near future if lessors sanction a reduction to the established allowable of 22,370 bbls. per day. The Ventura Avenue field, with a quota of 29,335 bbls. per day, has been producing approximately 4,200 bbls. daily in excess of this figure. The Lakeview section of the Midway-Sunset field is showing a daily overage of 4,000 bbls. and operators have not shown any inclination to conform with curtailment. The Alamitos Heights section of the Seal Beach field is producing 350 bbls. per day in excess of its daily quota and can be reduced to the daily allowable of 1,580 bbls. without much effort. The Elk Hills field of Kern County has just about reached its prescribed quota of 7,755 bbls. per day and the posted price of crude oil in this district is expected to be increased within the next few days.

Gas Demand Down

With the advent of spring the demand for natural gas has eased off to a substantial extent and it appears likely that this will be reflected in the production of dry gas in the several gas fields of the state. The Buttonwillow field of Kern County, which has been producing approximately 20,000,000 feet of gas per day for several months, has been shut in almost entirely as the Seaboard Oil Co. will limit its deliveries to Pacific Gas & Electric Co. to approximately 1,000,000 feet per day until the demand increases again next winter. The Amerada Petroleum Corp., which discovered a new gas field in the Tracy district of San Joaquin County, is expected to suspend production activities or reduce production to a small part of the amount which has been delivered to the Pacific Gas & Electric Co. during the winter. The lessened demand for natural gas will prevent operators in the Semi-Tropic, Delano, Buena Vista Lake and Goleta gas fields from going on commercial production for another several months. As a result of this condition, drilling operations in the gas fields are expected to be reduced to a minimum, although the Amerada is expected to continue conservative development in the Tracy gas field, where a substantial accumulation has apparently been discovered.

The Superior Oil Co. is building rig for No. 1 Buena Vista associates, to be drilled in the southern part of Buena Vista Lake in section 6-32-25. In the Delano gas field, located at the corner of Kern, Kings and Tulare Counties, the Standard Oil Co. is preparing to drill out cement in No. 1 Tulare Farms, bottomed at 3,308 feet and 8⅝-inch water string cemented at 2,415 feet. The Standard's test is located in Tulare County and if commercial gas production is developed, it will extend the productive limits of the Delano gas field over into Tulare County. Development work in the Buttonwillow gas field of Kern County has been suspended for several months and no further work is anticipated for the present. Union Oil Co. and Hancock Oil Co. are drilling a joint test in the Tulare Lake district of Kings County, and while this project, No. 1 Giannini, located in section 28-22-20, had a gas showing at 2,900 feet, it is rotating ahead at 3,453 feet. A formation test with the packer set at 3,297 feet resulted only in a normal gas blow which did not indicate the presence of sufficient gas to reveal possibilities of developing commercial production.

This important test is about 130 miles north of San Francisco (air line) in Tehama County and about the same distance south of the Oregon state line. It is near the town of Corning

Mountain View

The Hogan Petroleum Co. extended the proven limits of the Mountain View field of Kern County 1,000 feet to the southeast by completing No. 1 Peters in section 5-31-29 and definitely indicated that several additional locations would be found productive. No. 1 Peters flowed 2,240 bbls. of clean 31.6 gravity oil and 5,400,000 feet of gas initially, but production was reduced to 1,450 bbls. in the interests of conservation. A further reduction will be effected within the next few days. The well was bottomed at 6,048 feet and finished with an 8⅝-inch water string landed and cemented at 5,745 feet. It was completed with a 6⅝-inch liner including 278 feet of perforated. The bottom 25 feet of liner consisted of 25 feet of blank pipe. The top of the Chanac was found at 5,689 feet; first ash bed, 5,902 feet; top of the second ash bed, 5,930 feet, and top of the Wharton zone at 5,965 feet. It is flowing under a pressure of 360 pounds on the tubing and 980 pounds on the casing.

The Buffalo Oil Co. recompleted No. 1 Canal in the Mountain View field and it was brought in flowing 640 bbls. of relatively clean 28.9 gravity oil and 800,000 feet of gas per day from 5,117 feet. The well shows a tendency to head and consequently will require careful treatment during the next several days in order to maintain a sustained flow. Standard Oil Co. No. 1 Warren in section 13-30-28 was somewhat of a disappointment upon completion at 5,285 feet, after the hole had been finished with a 7-inch liner carying perforations at 4,918-45 feet and at 4,975-5,280 feet, as it was good for only 150 bbls. per day which showed a cut of approximately 10 per cent. The well appears to be cleaning up to some extent and consequently may show increased production after it has had a chance to clean itself out. Two new wells are expected to be completed in the Mountain View field during the forthcoming week and these should be followed into production by two more potential producers within a short time. The next two completions in the Mountain View field should be No. 7 Clendennen of the Mohawk Petroleum Co.

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and the Shell Oil Co. No. 5 on Porter lease No. 2.

Midway-Sunset

The Gibson Oil Co. has an excellent producer in the Maricopa section of the Midway-Sunset field of Kern County in No. 1 O'Brien, which was brought in flowing 1,170 bbls. of clean 23.2 gravity oil per day. It is located in section 6-11-23, was bottomed at 2,815 feet and finished with a 6⅝-inch liner including 50 feet of perforated. This is the second commercial producer finished by the Gibson Oil Co. in the immediate area and the satisfactory production developed is significant because wells on adjacent properties were small. General Petroleum Corp. has started an offset to the Gibson Oil Co.'s holdings and several additional wells are expected to be started within the next few weeks.

The Midway-Sunset field has been showing increased development for several months and completions of the Gibson Oil Co.'s new well will furnish additional incentive to operators to stimulate development in the older section of the field and drill additional outposts around the edge of the productive area. This field, due to the extensive amount of acreage involved and the limited data available, justifies considerable exploratory work. In the center of the field are a number of undrilled locations, but the most interesting drilling will be centered beyond present production. The Standard Oil Co. is building rig for No. 219 in section 33-22-24 and is rigging up rotary for Nos. 24 and 25 on the M.J.M.&M. property in section 36-12-24 preparatory to redrilling and deepening the holes. In section 33-32-24, the Standard is rigging up pumping equipment preparatory to a production test and is rotating ahead in No. 65-3-D in oil sand at 4,160 feet. Hugh B. Evans has picked up the pay in his No. 12 in section 35-32-23 and an early production test is anticipated.

Kern River

The Republic Petroleum Co. completed its seventh producing well on the Strassburger in section 24-28-27 when No. 9, a second line offset, was brought in pumping 330 bbls. of 15.6 gravity oil per day from 2,093 feet, after the hole had been finished with a 6⅝-inch liner including 223 feet of perforated. The Vega Oil Co. No. 1 in section 11-28-27, on the west front of the Kern River field, was brought in pumping 141 bbls. of 15.2 gravity oil per day from 1,725 feet. Rig is being built for No. 2 on the same property. The Texas Co. has just spudded in No. 14 Lehman in section 23-28-27. Standard Oil Co. is building rig for No. 2 Ward fee in section 24-28-27 and should spud in within 10 days. The Chanslor Canfield Midway Oil Co. No. 56 in section 23-28-27 is bottomed at 2,150 feet and should be given an early production test.

Drilling operations in the Edison field of Kern County resulted in the completion of two new wells. Berry Oil Co. No. 2 Grayson in section 10-30-29 was brought in pumping 118 bbls. of 15.2 gravity oil per day from 1,942 feet, but the output at last reports was still cutting approximately 20 per cent. No. 7 Knapp of the General Petroleum Corp. was good for only 45 bbls. of 15.6 gravity oil per day upon completion at 1,576 feet. The A. T. Jergins Trust spudded in No. 1 Brandt in section 22-30-29 and will probably have the bit making hole in No. 7 Andrews in section 23-30-29 within the next few days. Rigs are up for No. 6-B McCowan and No. 12 Hershey. The Union Oil Co. encountered Schist in No. 4 Dougherty at 2,412 feet and, failing to encounter a productive formation above the basement, abandoned the hole.

TANKER SHIPMENTS FROM LOS ANGELES TO DOMESTIC AND FOREIGN PORTS

	March 1		February 23			
Intercoastal-domestic:	Total this week	Daily average	Total this week	Daily average	This year to date	Same time last year
Diesel and gas oil	.....	.....	77,391	11,056	77,391	447,439
Gasoline	193,493	27,643	.....	.....	831,413	1,122,373
Kerosene	.....	.....	.....	.....	385,956	221,271
Foreign exports—						
Crude oil	269,285	38,469	258,501	36,929	1,433,286	1,572,422
Fuel oil	118,309	16,901	262,620	37,517	1,853,470	2,358,536
Diesel and gas oil	79,385	11,341	53,177	7,597	527,785	389,211
Gasoline	87,664	12,523	67,244	9,606	1,067,561	797,021
Kerosene	.....	.....	22,945	3,278	77,452	211,472
Other unfinished oil	.....	.....	3,420	489	3,420	37,097
Coastwise-domestic:						
Crude oil	156,070	22,296	60,122	8,589	952,850	1,348,080
Fuel oil	336,385	48,052	95,689	13,670	1,684,287	1,925,262
Diesel and gas oil	95,634	13,662	5,588	798	356,846	164,632
Gasoline	128,443	18,349	223,996	31,999	2,142,327	1,443,457
Kerosene	4,489	641	.....	.....	59,878	33,484

TANKER SHIPMENTS FROM SAN FRANCISCO TO DOMESTIC AND FOREIGN PORTS

Intercoastal-domestic:						
Diesel and gas oil	.....	.....	.....	.....	.....	78,075
Kerosene	.....	.....	.....	.....	.....	149,715
Asphalt	.....	.....	.....	.....	.....	71,325
Lubricants	.....	.....	1,779	254	1,779	12,381
Foreign exports:						
Crude oil	201,336	28,762	80,371	11,482	473,786	357,485
Fuel oil	209,948	29,993	60,804	8,686	523,649	309,621
Diesel and gas oil	.....	.....	100,856	14,408	100,856	125,612
Gasoline	85,009	12,144	44,176	6,311	717,192	627,812
Kerosene	.....	.....	128,082	18,297	163,009	121,016
Lubricants	.....	.....	12,368	1,767	43,008	44,246
Coastwise-domestic:						
Fuel oil	83,181	11,883	115,361	16,480	1,211,136	600,395
Diesel and gas oil	.....	.....	.....	.....	76,898	47,468
Gasoline	78,262	11,180	63,053	9,008	770,485	757,954
Kerosene	4,686	669	4,203	600	24,588	10,149

Mount Poso

The General Petroleum Corp. completed two new wells in the Mount Poso field of Kern County and should have another, No. 17 Heisen in section 16-27-28, ready for production within 10 days. No. 15 Heisen lease was completed, pumping 206 bbls. of 15.6 gravity oil per day from 1,683 feet and No. 16 Heisen, 241 bbls. of 15.9 gravity oil daily from 1,742 feet. The Baker-Grover Oil Co. has rig up for No. 4 Glide in section 33-27-28 and an early spud is expected. The Texas Co. is bailing No. 10 Vedder in section 4-27-28, total depth 1,750 feet. In the Premier area, the Ausbrit Oil Corp. is considering plugging back No. 1 in section 20-27-27 in order to test an oil sand found above the bottom of the hole, which is 2,125 feet. The top of the Etchegoin was logged at 1,940 feet and an oil sand at 2,075 feet. The top of the Chanac was picked up at 2,105 feet.

The Barnsdall Oil Co. will probably have No. 3 Caldwell in the Round Mountain field of Kern County ready for a production test soon. Preparations are being made to run in and cement an 8⅝-inch water string. The California Western Oil Co. has concluded drilling on its No. 16, in section 7-28-29, and it should be on production this week. It was drilled from spud to completion in 15 days. Rig is up for No. 17. Honolulu Oil Corp. has started bailing No. 92, in section 18-28-29, total depth 2,100 feet, and indications point to an early completion. No. 91 in the same section is being rigged up and should be spudded in a few days. The Shell Oil Co. recently spudded in No. 3 Caldwell in section 7-28-29. The Ohio Oil Co. is running a formation tester in No. 1-D on the Kern County Land Co. lease in the Rio Bravo district of Kern County in section 1-30-25. In the Stevens area, the Shell Oil Co. is rotating ahead in its test on the Kern County Land Co. lease in section 29-30-26 at 6,250 feet, but has not yet logged any indications of importance. The Reserve Oil & Gas Co. suspended drilling operations on No. 5 Tejon in the Wheeler Ridge-Tejon district of Kern County at 2,585 feet and is rigging up rotary drilling equipment in No. 1 Ritchie in section 33-11-19 preparatory to a resumption of work at 6,032 feet.

Javon Area

The Continental Oil Co. killed its No. 1 Hobson, the discovery well in the new Javon field of Ventura County, in order to undertake corrective work made necessary by the appearance of fresh water in the discovery well's production. Before being killed the production of No. 1 Hobson was cutting approximately 11 per cent. A

(Continued on Page 189)

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ONLY SIX NEW COMPLETIONS IN WEEK IN RODESSA DISTRICT

By J. R. CRUMPTON

SHREVEPORT, La., Mar. 16.—The North Louisiana and Arkansas districts reported an ordinary week of drilling operations with no wildcats of importance on the completion list. Rodessa listed six completed wells and two others in the old Caddo field made up the total with no dry holes in North Louisiana. The Arkansas district showed signs of more activity than since the first of this year.

Haynes Production Co. finished two wells in the Rodessa field, both within the proven areas of section 14-23-16, the most prolific area to date in the field. Its No. 7 Sexton in the NW cor. SW NE, made 86 bbls. per hour through 1¾-inch tubing choke from total depth of 6,073 feet, subsea depth of 5,665 feet. Top of saturation was logged at 6,044 feet and tubing pressure registered 1,100 pounds. The same company's No. 8 Sexton, 330 feet north and east of SW cor. NW SE, flowed 186 bbls. per hour through 1¾-inch choke on tubing from 6,037 feet, subsea depth of 5,774 feet, casing pressure registering 600 pounds and tubing pressure 250 pounds. Pelican Oil & Gasoline Co. No. 13 Sexton, 330 feet north and west of SE cor. section 14-23-16, topped saturation at 6,000 feet, set 7-inch casing at 6,001 feet and was washed in flowing 35 bbls. per hour through one-quarter inch tubing choke from 6,010 feet. United Gas Public Service Co. reported three completions. Its No. 5 Bremer unit, section 22-23-16, set 7-inch at 5,997 feet after topping saturated lime at 5,980 feet. The well flowed 45 bbls. per hour through one-half inch choke on tubing from total depth of 6,020 feet. In the same section, its No. 2 Spearman made 79 bbls. per hour on one-half inch choke on tubing from total depth of 6,000 feet, subsea depth of 5,779 feet. In section 15-23-16, United Gas Public Service Co. No. 1 Harris was completed making 31 bbls. per hour through one-half inch tubing choke from 6,020 feet, subsea depth of 5,781 feet.

J. Edward Jones No. 1 Neugent, section 23-23-16, within the Rodessa townsite, had a show of around 4,000 feet of oil in the hole with the total depth at 6,010 feet. The casing was shot on that test from 5,993 to 6,001 feet, 5¾-inch having been set at 6,007 feet. Casing was afterward perforated with 36 shots from 5,984 to 6,005 feet and the well is standing 3,500 feet in oil. M. H. Marr and others No. 4 Hunter, section 13-23-16, on the northeast trend, shot 7-inch casing set on bottom at 6,052 feet and the test flowed 28 bbls. per hour, 15 per cent salt water. Operators are plugging back on the hole to shut off the water flow.

The Standard Pipe Line Co. of Louisiana, which limited its take of production in the Rodessa field to 15,000 bbls. daily during the month of December and since, has announced that it will run the 8-inch line capacity to its main line from Oklahoma to Baton Rouge. Magnolia Petroleum Co. is rapidly completing a 25-mile line into the field from its El Dorado-Beaumont line and Gulf Refining Co. has a 6-inch line into the Rodessa field. Eastern Texas Production Co. is reported to be making arrangements to build an 8-inch line to its refinery at Longview. The Rodessa allowable per well has been fixed at 400 bbls. daily for the month of March by the Minerals Division of the State Conservation Department. Reports of hot oil shipments from this field were erroneous to a great extent, practically all of it being moved in small quantities by local trucks. Gov. James A. Noe took the matter in hand about two weeks ago and assures all parties concerned that there is no hot or illegal oil now being moved from the Rodessa field. Agents of the conservation department have been reinforced by special officers of the bureau of identification and criminal investigation and no further traffic in the local hot oil movements is anticipated. The operators in the Rodessa field have always shown a tendency to cooperate with the governing bodies in curtailing their production.

In the Hosston area of Caddo Parish, Bayou State Oil Corp. No. 3 Brown, section 28-22-15, has an estimated daily flow of 500,000 feet of gas from 958 feet. In the Dixie area, Simplex Oil Co. No. 2 Natalie, section 10-20-15, is flowing by heads 240 bbls. daily through 2-inch tubing from total depth of 2,202 feet.

Among the Wildcats

None of the important wildcats were on test during the past week, but a number of them are rapidly reaching the anticipated pay zones. Lide, Greer & Marr No. 1 Davis Brothers Lumber Co., section 12-16-5w, Bienville Parish, on what is locally known as the Union Church structure, is fishing for roller bit and cones at total depth of 5,822 feet. The corrected top of anhydrites was logged at 5,162 feet with the base of massive anhydrites at 5,606 feet. In the southwestern part of Bienville Parish in the Lake Bisteneau gas area, DeSoto Oil & Gas Co. No. 1 C. R. Mower, section 9-16-10, is drilling at 2,825 feet. A proposed deep test in the Blanchard gas area of Caddo Parish, Pyramid Oil & Gas Co. No. 1-A S. R. Wheeler, section 16-18-16, topped Blossom sand at 1,924 feet, topped red beds at 2,850 feet and is drilling in lime at 3,240 feet.

J. P. Evans and others No. 1 T. Crichton, section 35-18-9, a potential 6,000-foot test on the Dubberly-Sibley structure in the southern part of Webster Parish, has set 12½-inch surface casing at 156 feet and is drilling at 2,350 feet. A few miles east and north of the town of Ruston in Lincoln Parish, Arkansas-Louisiana Gas Co. No. 1 C. E. Causey, section 32-19-2w, has set 10¾-inch casing at 827 feet. Other North Louisiana wildcats follow: Caldwell Parish, Critchett & Woods No. 1 Kyles, section 18-11-3e, drilling at 1,620 feet; Claiborne Parish, W. C. Glothlin and others No. 1 Brinker, section 10-23-4w, temporarily shut down at 3,196 feet; Triangle Drilling Co. No. 1 Kilpatrick, section 7-19-5, on the southern flank of the Sugar Creek gas field, arranging to deepen from 4,458 feet; United Gas Public Service Co. No. 2 Durrett, section 31-20-5, in the Sugar Creek field, reported a showing of oil with the total depth at 5,655 feet. The test is reaming to bottom and will probably make a drill stem test of the show. S. S. Alexander No. 1 J. R. Stell, section 5-12-16, DeSoto Parish, is shut down in lime and shale at 5,595 feet. In the same parish, J. K. Wadley and others No. 2 Logan Oil Co., section 16-10-12, set 7-inch casing at 3,065 feet after coring sand showing oil from 3,158-68 feet. The hole is bottomed at 3,184 feet. Ohio Oil Co. No. 1 R. L. Holloway, section 23-21-10, a deep test in the Cotton Valley field, Webster Parish, is coring at 6,350 feet.

ARKANSAS

Three completions reported from this district consisted of one oil well and two dry holes. Grigsby & Aarnes No. 1 W. Burris, section 19-15-19, Ouachita County, was dry and abandoned in red and blue shale at total depth of 4,017 feet. In the Rainbow field of Union County, Ohio Oil Co. No. 6 R. Pumphrey, section 12-17-14, is flowing 810 bbls. daily from the red beds at 3,173 feet. Another Union County test, F. C. Henderson No. 1 J. M. Sheppard, section 35-17-15, was dry and abandoned at 2,192 feet. The well previously tested a small show of oil and 125,000 feet of gas with 150 pounds rock pressure.

Odell Hinson has spudded in on his No. 1 Montana Realty Co. in section 3-17-28, Miller County. The wildcat test, proposed to drill to the 6,000-foot level, is about 9 miles south of the city of Texarkana and between the Miller County and Rodessa fields. In Ashley County in the southeastern part of the state, Seaboard Oil Corp. No. 2 fee, section 28-17-4, topped chalk rock at 2,250 feet and is coring at 2,281 feet. Fitzwater and others No. 2 Lafferty, section 17-14-24, Hempstead County, is reaming to set 7-inch casing to test a show of sand contacted at 1,980 feet. The hole is bottomed at 1,986 feet. Erwin & Leach No. 3 Bodcaw Lumber Co., section 20-16-23, in the Stamps area, Lafayette County, is still fishing for stuck drill stem at 4,150 feet. A few miles southwest of this test, Earl F. Fox No. 2 Coleman Brothers, section 26-16-24, has resumed operations to deepen, and drilling in shale and red beds at 3,241 feet. Two other Lafayette County tests, Joe Modisett No. 1 Red River Lumber Co., section 21-19-24, is drilling at 2,831 feet, and Transportation Petroleum Co. No. 1 Cockran, section 26-19-23, is bailing to test a show of oil from 12 feet of sand from total depth of 3,670 feet. Phillips Petroleum Co. No. 1 J. D. Reynolds, section 27-15-15, Ouachita County, is drilling in hard gray shale with streaks of red beds at 3,705 feet.

East Texas Border Counties

American Liberty Oil Co. No. 1 D. A. Maxie, John Collum Survey, Cass County, and southwest of the Rodessa field in Caddo Parish, topped anhydrites at 5,065 feet and is drilling at 5,129 feet. The same company is moving in rig on No. 1 Marcus Rembo, J. H. Reeves Survey. United Gas Public Service Co. is making good progress on two tests in Cass County, a short distance inside the line from Louisiana. Its No. 1 J. R. Jones unit, Ben Murray Survey, topped anhydrites at 5,035 feet and is drilling at 5,572 feet. Its No. 2 J. R. Jones unit, same survey, logged base of massive anhydrites at 5,517 feet, top Hill sand at 5,664 feet, top of Gloyd sand at 5,814 feet and is drilling at 5,985 feet.

A wildcat test in Shelby County, Tarvbud Oil Co. No. 1 Pickering Lumber Co., W. D. Woodfin Survey, was abandoned in salt water at 5,418 feet.

Production Kept Down

The Rodessa field's production was again held down to around 36,000 bbls., or far below its ability to produce, and as a result North Louisiana's total production was limited to 57,150 bbls. per day. The average daily production of North Louisiana and Arkansas for the week ending March 14 follows:

NORTH LOUISIANA

Bellevue	435
Caddo Light	4,110
Caddo Heavy	2,450
Converse	1,100
Cotton Valley	350
De Soto and Red River	1,325
Elm Grove	425
Haynesville	3,385
Holly	155
Homer	3,570
Pleasant Hill	150
Rodessa	36,280
Sarepta-Carterville	495
Urania	2,655
Zwolle	1,265
Total	57,150

SOUTH ARKANSAS

Champagnolle	3,480
El Dorado	2,100
Lisbon	295
Miller County	945
Nevada	800
Smackover Light	2,100
Smackover Heavy	17,380
Stephens	580
Urbana	2,985
Total	29,765

West and North Texas

By L. E. BREDBERG

NEW POOLS AND EXTENSIONS IN WEST AND CENTRAL AREAS

FORT WORTH, Tex., Mar. 16.—Water in one wildcat and the apparent exhaustion of salt water in an impotant discovery; completion of an interesting extension in the Kermit area and extensions in two directions to the Sayre-Howe pool, the latter in Winkler County, were the features for the week in West Texas.

One of the most interesting and carefully watched wildcats drilling in West Texas; one which has encountered several good showings of gas, nearly everyone of which was of sufficient volume to blow tools up the hole and cause fishing jobs, struck the wildcatter's scourge, sulfur water, at 4,813-15 feet in lime and is now appearing as a failure.

This test, located in section 228, Block G, W.T.R.R. Survey, 3 miles northwest of Seminole in Gaines County, is being drilled by W. T. Walsh and the Harry Adams Corp. on the Averitt ranch. It marks the second dry hole in the county within three weeks, another test drilled about 13 miles farther to the northwest and located in section 414, Block G, having proved dry. It was drilled by Wahlenmaier and others to a total depth of 5,225 feet where it is shut down for orders. However, it may possibly be carried deeper. Both tests are on the trend between the Means field to the south in Andrews County and the Yoakum County discovery in the southeast corner of that county.

Yoakum County Wildcat

Cascade Oil Corp. and Honolulu Oil Corp. No. 1 Bennett, in section 678, Block D, John H. Gibson Survey, southeast Yoakum County, which has been showing for a small producer at 5,112 feet, but which last week showed salt water in discouraging amounts, has been bailing all week with satisfactory results. The water was almost exhausted and 2,400 feet of oil was standing in the hole, coming in at the rate of around 1 bbl. per hour. Tubing is to be run and the hole treated with acid at its present depth. Treatment of the lime and its results will be closely watched for this wildcat strike, which topped the pay at 5,004 feet, looks like the opener of an entirely new sector to the West Texas district. It caused a widespread lease and royalty play in Yoakum and adjacent counties several months ago when the showing was first made. It was shut down for three months on account of litigation, during which time interest in the area subsided considerably, only to be aroused again when testing started on the well.

Winkler Extension

Humble Oil & Refining Co. and others No. 1-D Walton, in section 20, Block 74, between the Sayre-Howe and Scarborough pools in northern Winkler County, presages the linking of those two areas. It flowed 482 bbls. of oil in 24 hours after the lime was shot to total depth of 2,930 feet.

Cherry and Keyes No. 1 Central State Bank of Abilene, in section 25, Block 26, 1½ miles northeast of Kermit, and between production in that area and the Sayre-Howe pool to the north, flowed at the rate of 595 bbls. of oil per day with 2,500,000 feet of gas, on proration test this week. Total depth is 2,878 feet in lime and sand. This too marks an important extension and link for these two areas. This well, coupled with the above mentioned Humble extension north of the Sayre pool, makes the sand trend east of the Hendricks field, look sure of linking up for miles from the north to the south, practically all the way from the Halley wells on the extreme south in section 25, Block B-11, to the north end of the Scarborough pool, a distance of about 20 miles. However, there are spots along the trend which are producing small wells, and the field will no doubt be narrow, but it is proving of major importance. Many thousands of producing acres are being added each week as new wells are completed and extensions made.

The Texas Co. No. 1 Daugherty, in section 2, Block 74, P.S.L. Survey, nearly 1 mile west of the Scarborough pool in northern Winkler County, is to be completed for a small pumper and western extension to that pool. It was plugged back from 3,300 feet to 3,235 feet and given a shot of nitroglycerin and is now being put on the pump.

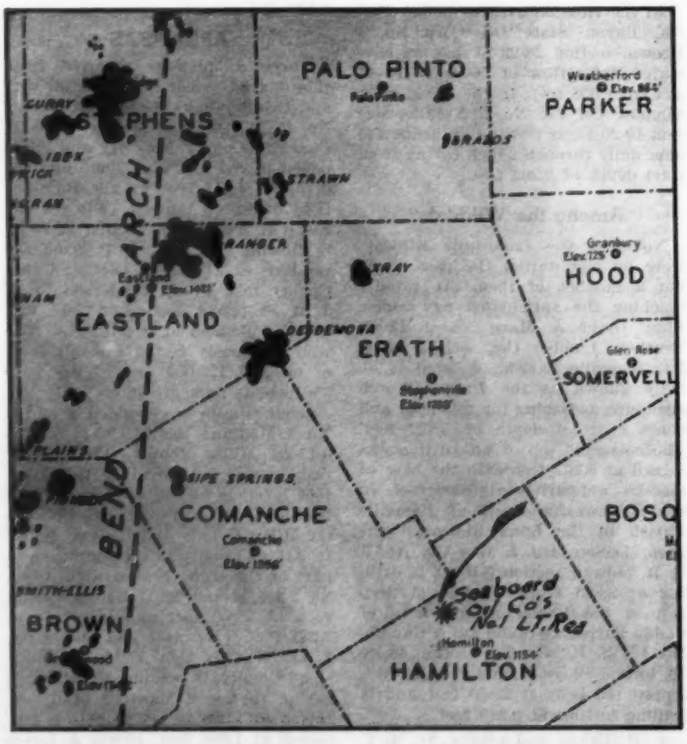
Ector Outpost

William Dunning and others No. 1 Scharbauer, located in section 33, Block 44, Township 1n, T.&P. Survey, 2 miles south of a small well in section 20, and 1½ miles northwest of the Goldsmith discovery in Ector County, either opens another producing area or marks a considerable extension, if not a connecting link between two areas, for the county. It came in making from 8 to 10 bbls. of oil per hour with an estimated 15,000,000 feet of gas daily, after shooting with nitroglycerin at total depth of 4,175 feet in lime. The Gulf Oil Corp. has already staked location for a south offset to the new well, in section 4, and Landreth and Humble Oil & Refining Co. will probably stake offset locations at once.

Tubbs Area—Crane County

The Community test drilled by the Sinclair Prairie Oil Co. in section 3, Block B-27, in the Tubbs, area, western Crane County, where two wells are producing from the Permian lime and one from the Ellenberger, member of the Ordovician, has been completed for a small pumper, making from 6 to 7 bbls. per day at total depth of 3,164 feet, thereby validating the leases held by the five or six companies interested. However, the well was first started as an Ordovician test, and will no doubt be carried on deeper to the Ellenberger, from which Gulf has a producer about 1½ miles to the northwest in section 4.

Humble Oil & Refining Co. is also completing its well in this area in the Permian, but will no doubt carry it on deeper if it does not prove a good commercial producer from the shallower formation. It is located in section 11, block B-27, 4 miles southeast of the Gulf-Tubbs Ordovician discovery in this area, the second Ordovician pool opener in the district. The Humble test ran 2½-inch tubing to 4,375 feet, the bottom, and is now swabbing.



Seaboard Oil Corp. No. 1 L. T. Rea Heirs, wildcat gas discovery, 12 miles northwest of Hamilton in Hamilton County. Total depth is 2,455 feet. Estimated gas potential 11,000,000 feet daily

(Map courtesy Zingerly Oil Map Co., Fort Worth, Tex.)

Concho County Wildcats

The two interesting wildcats drilling in eastern Concho County, one of which showed for a small oil producer and the other a gasser, are now shut down. The former, Maverick Oil Co. No. 1 Jim Rice, in section 18, I.&R.R. Survey, 4 miles northwest of Melvin, is waiting on orders at 2,161 feet after drilling Ellenberger lime at 2,117 feet without any oil or gas showings. If not carried deeper it will probably be plugged back to shoot the Strawn sand which showed for production between 1,835-42 feet several weeks ago.

John W. Westbrook No. 1 Ledbetter, in section 2, Survey 1,673, 6 miles southwest of the Maverick wildcat, is now down to 2,112 feet waiting on 5-inch casing. It also drew attention about 13 days ago when it struck an estimated 500,000 feet of dry, sweet gas at 2,110 feet.

Another Wildcat for Yoakum

An interesting proposed test for Yoakum County, about 15 miles southwest of the Bennett discovery in section 678, will be drilled by Bahan & Rhodes of Abilene, if proposed plans materialize. It is to be put down to 5,500 feet in section 367, Block D, John H. Gibson Survey.

Jones Wildcat

Tom B. Medders is to drill a 2,000-foot wildcat in section 42, Block 14, T.&P. Survey, 5 miles southeast of Nugent, near an old dry hole drilled some time back by the same operator. The Fain-McGaha Oil Corp. also started up on a wildcat on the Nettie Hayden farm, 2 miles north of the Hawley pool. Location is in the G.

Martinez Survey No. 195. This is the third test to be drilled in this area north of the field for the present.

Upton Wildcat Failure

John W. Emch No. 1 Mrs. A. E. Gordon, located in section 47, Block Y, T. C. Railway Survey, on the extreme east edge of Upton County, has been marked down as another failure for the Permian Basin. It struck sulfur water at 3,740 feet, 80 feet in the lime, and has been given up at that depth.

Keyes & Cherry and others abandoned No. 1 Ed S. Hughes, in the Hughes producing area of eastern Crane County, at 2,409 feet, after striking sulfur water 1 foot above. It is located in Survey No. 2, Julia Prater Survey.

L. R. Stroud and others are planning on drilling a wildcat test on the J. Mosley lands in the extreme southeastern corner of Crane County. Tentative location is in section 4, Block 31, H.&T.C. Survey. The operators have some 3,300 acres in a block in this area. Location is about 2 miles west of a dry hole drilled some time ago in section 17.

Wichita Falls District

Activities are again picking up in the North Central Texas, or Wichita Falls, district. This week 51 locations were staked for new tests, while at the same time 57 wells were completed, many of them dry.

New Sand in Gainesville Pool

The Burke Royalty Co. has completed its No. 1 Mrs. L. J. Jones, a west offset to that company and Martin's discovery well on the Jones Farm, 2½ miles southeast of Gainesville, in Cooke County, has been completed for a 20-bbl. well from the Strawn sand topped at 1,800 feet. It was bottomed at 1,815 feet, opening a second and new sand for this shallow pool in which two other producers are making only 15 bbls. per day together, from sand logged around 1,600 feet. There are nine tests going down in the area around Gainesville, most of them seeking production found in the pool southeast of the town. Two miles due east of the town, Anderson & Kerr of Oklahoma have a test showing considerable gas with prospects of opening another pool near the town. It was shut down at 1,900 feet to set casing. This test is about 1½ miles north of the recently discovered Martin Pool, with a dry hole having been drilled between the two areas a short time ago.

3,400-Foot Test

Sterntex Oil Co. has made location on the D. Lindsey farm in the I. N. Wright Survey, Abstract 898 for a 3,400-foot test west of an old well previously drilled by Buttram and others on the Boyd farm. This new wildcat will be located about 10 miles north of Jacksboro in Jack County.

Production in the district averaged a little better than 62,400 bbls. per day during the week.

The Maverick Oil Co. of San Angelo has sold half interest in a block of leases covering slightly more than 5,215 acres in southeastern Stephens County, to Homestead Oil & Gas, Ltd. of Ontario, Canada. Two tests are to be drilled, one to the black lime around 3,100 feet, and to be carried to 3,400 feet to the gray lime if the black does not pay off. The other test is to be located in the James Erwin Survey 6 miles northwest of Strawn and the other 5 miles farther north in Block 4, H.&T.C. Survey. There is production in both areas, the majority of the wells having been drilled about 18 years ago.

Panhandle District

Twenty-two locations were staked in the Panhandle district with only 13 tests completed, all proving producers, either of oil or gas.

Holmes and associates made the most interesting location in the district this week. It is in section 34, Block Z, E.L.R.R. Survey, one-half mile east of production and north of the river in Hutchinson County. If it makes a well it will extend production that distance to the east and open more territory to development north of the river.

Lease Deal Closed

One of the largest lease deals and obligatory drilling contracts made in the Panhandle district in a long time, was closed this week by the Huber Petroleum Co. with Dave Rubin who leased the company's 11,622½ acres in the western part of Hutchinson County and north of the Canadian River and north and west of the Stinnett oil development. The contract calls for 15 tests to be drilled on the block, the first to get under way by April 1. Five of the tests are to be drilled for oil and the remainder only to go to the gas pay if the company so chooses. The block falls in the sour gas area. The company operates carbon black and gasoline plants in the area and will lay lines into the block to connect with these plants in case any or all of the tests prove producers. The plants will no doubt be enlarged if production on the block merits same or necessitates such additional capacity in the plants.

Hamilton Gasser

The Seaboard Oil Co. completed No. 1 Rhea Heirs, in the David Cooke Survey, about 12 miles northwest of Hamilton in Hamilton County. It is a gasser estimated as good for 12,000,000 feet per day. However, part of the gas sand was cased off and the initial production of the well is now around 5,000,000 to 7,000,000 feet per day, with rock pressure reported 1,160 pounds. The gas will be used in drilling another test on the large block held by the company in the area. Total depth of the well is 2,455 feet. This is the first commercial gas or oil production ever struck in the county, which recently attracted attention from independents and major companies alike, and in which several blocks have been taken with contracts to drill.

NORTH TEXAS COMPLETIONS

Completions in the past week in the North Texas area, with top of sand and total depth records and initial production were as follows:

Archer County

B. Cochburn No. 1 F. Brezina, dry and abandoned, 1,432 feet. Consolidated Oil Co. No. 2 Wilson, 2,226-2,237 feet, 1,200 bbls. Fain McGaha No. 1 Morrison B, dry and abandoned, 1,374 feet. Fraser & Proctor No. 1 Harris, dry and abandoned, 1,025 feet.

H. Hines No. 1 Cullum-Jones, dry and abandoned, 1,742 feet. Huggins Oil Co. No. 10 Ford, 990-1,004 feet, 15 bbls. W. T. Hutchinson Jr. No. 1 McCrory B, dry and abandoned, 2,292 feet. Perkins & Cullum No. 21 Abercrombie, dry and abandoned, 1,252 feet; No. 1 E. T. Brown, dry and abandoned, 1,614 feet. Shappell Oil Co. No. 1 McCrory Tr., dry and abandoned, 629 feet. Underwood Drilling Co. No. 2 Ward D, dry and abandoned, 1,040 feet.

Baylor County

Consolidated Oil Co. No. 19 Portwood R, 1,331-1,368 feet, 412 bbls. T. F. Hunter No. 1 A. J. Kuhlanck, dry and abandoned, 1,588 feet. Ray & Staniforth No. 41 Portwood C, 1,351-1,357 feet, 350 bbls.; No. 42 Portwood C, 1,341-1,360 feet, 300 bbls.

Clay County

S. Clum No. 1 Adams, dry and abandoned, 237 feet. H. T. Merrill No. 1 C. Lennen, dry and abandoned, 855 feet.

Cooke County

Anderson & Kerr (formerly W. F. Johnson) No. 1 P. Gentzke, dry and abandoned, 1,994 feet. Burk Royalty Co. No. 1 Mrs. L. J. Jones, 1,800-1,815 feet, 20 bbls. T. P. Frost No. 1 J. Rhomer, 818-850 feet, 25 bbls. Hester Oil Co. No. 2 Trew A, 1,091-1,099 feet, 250 bbls. Larkum & Warr No. 1 Randall, 1,593-1,607 feet, 35 bbls.

F. W. Merrick, Inc., No. 1 G. T. Andress, 752-795 feet, 30 bbls.; No. 24 A. Knabe, 782-797 feet, 8 bbls.; No. 26 A. Knabe, 758-792 feet, 5 bbls. Schermerhorn Oil Corp. No. 1 F. J. Hess B, dry and abandoned, 967 feet. Seitz et al No. 3 Trew A, 1,134-1,206 feet, 45 bbls. Sessions et al No. 1 Beeker, dry and abandoned, 1,168 feet. Vindicator Oil Co. No. 5 Walterscheid, 780-798 feet, 35 bbls.

Montague County

Barnsdall Oil Co. No. 10 Cunningham, temporarily abandoned location. Pure Oil Co. No. 7 Maddox B, 892-920 feet, 30 bbls.

Wichita County

Bourbon Royalty Co. No. 1 J. A. Watkins, dry and abandoned, 893 feet. Cullum and Alexander No. 1 Burnett et al, dry and abandoned, 350 feet. Magnolia Petroleum Co. No. 9 R. R. Hamilton, 1,853-1,870 feet, 22 bbls. The Texas Co. No. 417 Waggoner A, completed 1,590-1,599 feet, 60 bbls. Texas Co. No. 1 Waggoner Q, 1,858-2,040 feet, key well for repressuring.

Wilbarger County

Bason Drilling Co. No. 1 Waggoner A, 1,998-2,012 feet, 50 bbls. Empire Gas & Fuel Co. No. 22 Waggoner A, 2,540-2,543 feet, 250 bbls.

Jack County

J. W. Jackson No. 1 Bloodworth, dry and abandoned, 350 feet. Brazos River Gasoline Co. No. 3 Moore-Clayton, 2,969-2,974 feet, 6 bbls. Engineers Oil Properties No. 1 Manley, temporarily abandoned location.

Wise County

W. B. Hamilton No. 1 S. L. McNay, dry and abandoned, 2,003 feet.

Throckmorton County

B. F. Looney No. 1 Robinson, dry and abandoned, 412 feet.

Young County

Alexander and others No. 1 G. B. Hamilton, 905-893 feet, 165 bbls. Collins & Labuzan No. 1 Jennings, dry and abandoned, 760 feet. Duncan & Holt No. 2 Benson B, 899-913 feet, 40 bbls. Gorsuch Oil Co. No. 18 Mathews, 714-721 feet, 10 bbls. T. F. Hunter No. 2 Taack B, dry and abandoned, 1,201 feet. B. F. McNatt No. 4 Montgomery, dry and abandoned, 525 feet. Ray & Staniforth No. 1 Wooten, dry and abandoned, 2,840 feet.

E. C. Reed No. 1 J. A. Watson, dry and abandoned, 587 feet. A. H. & S. P. Schmitt No. 6 Andrews, 899-904 feet, 25 bbls. S. H. Simon No. 1 Morrison, dry and abandoned, 614 feet. Snoddy & Snoddy No. 1 R. D. Webb, dry and abandoned, 782 feet. Stovall & Son No. 17 fee, dry and abandoned, 4,228 feet. Underwood & Campbell No. 10 Campbell A, 904-906 feet, 30 bbls.; No. 1 Campbell D, 890-902½ feet, 125 bbls.; No. 2 Campbell, dry and abandoned, 981 feet. J. G. Wooten and others No. 9 J. H. Horton, 595-599½ feet, 25 bbls.

COMPLETIONS IN CENTRAL TEXAS

Completions in Central Texas not heretofore reported, with the initial production of the oil and gas wells, follow:

Brown County

Hightower Oil & Refining Co. No. 1 Stone, dry and abandoned at 2,151 feet.

Callahan County

Beams Producing and Development Co. No. 12-D Jackson, top of pay 1,205 feet, 40 bbls. Jackson and Green No. 1 Ramsey, top pay 1,244 feet, 10 bbls. oil, 2 bbls. water. Samples and others No. 1 Finley, dry and abandoned at 650 feet. Turnbow No. 1 Sherrell, dry and abandoned at 1,956 feet.

Ungren & Frazier No. 1 G. Jackson, dry and abandoned at 1,250 feet. Warren No. 1 Hatchett, dry and abandoned at 826 feet. West and others No. 1 Robertson, dry and abandoned at 900 feet. Wittmer Oil & Gas Properties No. 1 Bowles and others, total depth 1,300 feet, 1,702,000 feet of gas.

Coleman County

Anzac Oil Corp. and others No. 17 Overall, total depth 2,348 feet, 60 bbls. Groves and others No. 1 Morris, dry and abandoned at 3,805 feet. Empress Oil & Gas Co. and others No. 1 Robertson, temporarily abandoned at 610 feet.

Comanche County

States Oil Corp. No. 1 Huckabee, total depth 2,862 feet, 25 bbls.

Eastland County

Case Brothers No. 1 Hampton, dry and abandoned at 2,873 feet. Hoff and others No. 1 Higgins Estate, dry and abandoned at 1,487 feet. Hoff No. 1 Wright, dry and abandoned at 1,486 feet. Walton and others No. 1 Johnson, dry and abandoned at 3,132 feet.

Haskell County

Anderson and Kerr No. 1 Ivy, temporarily abandoned at 1,740 feet. Duffey No. 1 Scott and others, temporarily abandoned at 200 feet.

Shackelford County

Condor Petroleum Co. No. 1 Reynolds, dry and abandoned at 1,930 feet. Dean Brothers No. 1 Newell, total depth 1,459 feet, 25,000,000 feet of gas. Eppenauer Drilling Co. No. 1 Morris & Buie, dry and abandoned at 1,648 feet. Gilman No. 1-A Herron, dry and abandoned at 1,052 feet.

Grisham & Hunter Corp. No. 1 Blank, dry and abandoned at 1,275 feet. Humble Oil & Refining Co. No. 1 Nail, dry and abandoned at 1,697 feet. Humble Oil & Refining Co. No. 1-137 Nail, total depth 1,555 feet, 50

(Continued on Page 189)

Eastern Field Report

By STAFF CORRESPONDENT

SIXTEEN WELLS COMPLETED IN LOWER EASTERN FIELDS

PITTSBURGH, Pa., Mar. 16.—Two additional deep tests are starting on the Milliken anticline in Elk district, Kanawha County, West Virginia. The Yoak Oil & Gas Co. is hauling in the rig material for a second test on the W. T. and J. H. Goshorn farm and the location is on Indian Creek, 4,315 feet south, 60 degrees east, 20 degrees from the No. 1. Benedum & Trees are building the rig for a second test on the Mary C. Wingfield farm and the location is about 1,600 feet due south of the No. 1. The elevation at the mouth of the well is 845.19 feet.

In this district, the Columbian Carbon Co. has six wells drilling. No. 4 G. and D. Copenhaver is drilling at 4,810 feet, and No. 3 at 4,080 feet. The test of the W. L. Burdette farm, which had been a gas well gauging over 900,000 feet in the Brown shale is being deepened and is now at 4,839 feet. The test on the W. H. Baxter and others lease is temporarily shut down at 4,650 feet. On the Elkland Improvement Co. tract this company is drilling at 1,110 feet and on the M. M. Robertson farm at 2,400 feet. In this district, V. C. Smith and others are deepening the test on the Matheny, Wertz and others lease on the island at the mouth of Coopers Creek and expect to go to the Newburg sand. It is shut down at 5,320 feet with a fishing job.

Sixteen completions during the past week in the lower eastern fields consisted of seven oil wells, two dry holes and seven gas wells.

SOUTHEAST OHIO

In Licking County, Ohio, the Edward H. Everett Co. completed a fair well on the Jacob J. Nethers Heirs No. 3 in the SW quarter section 19, Hanover Township. It was drilled in the Clinton sand at a depth of 3,088 feet and produced 25 bbls. the first day, naturally, which was increased to 130 bbls. a day after shot.

In Coshocton County, Moore and others completed a test on the Wheeler Mossholder farm in section 15, Perry Township, in the Clinton sand at a depth of 3,080 feet. It is a gas well gauging 1,000,000 feet a day.

In Knox County, D. C. Highman and others drilled a test on the H. V. Ulrey farm in section 14, Clay Township, through the Berea sand to a depth of 735 feet. There was a very small showing of oil and it is doubtful if it will be tubed.

In Muskingum County, the Mid-East Gas Co. test on the J. W. Elson farm in the SE quarter section 30, Harrison Township, was completed in the Clinton sand at a depth of 4,136 feet and is a gas well gauging 700,000 feet a day. In the NE quarter section 3, Rush Creek Township, the Hopewell Fuel & Gas Co. completed a test on the Anna Carroll farm at a total depth of 4,250 feet. The test was dry in the Clinton sand except for a light showing of oil, but will make about a 10-bbl. pumper in the Medina sand.

SOUTHWEST PENNSYLVANIA

In South Franklin Township, Washington County, H. G. Whitfield completed the test on the Judson Iams farm at a total depth of 1,038 feet. The Dunkard sand was at 983 feet with some gas showing at 995 feet and oil at 996-1,002 feet and oil and water at 1,036-38 feet. It is estimated good for 3 bbls. a day.

In Jackson Township, Green County, the Equitable Gas Co. completed deepening No. 1 Cole at 3,539 feet. The Bayard sand was at 3,485-3,507 feet with gas at 3,498-99 feet. The Bayard Stray sand was at 3,518-21 feet with some gas at 3,519 feet. The volume was 176,000 feet a day, which blew down to 104,000 feet.

In Amwell Township, Washington County, along the Fifth sand streak, the Union Gasoline & Oil Corp. has reached 2,668 feet in the test on the MacClanathan farm (Van Kirk). The top of the Gantz sand was at 2,655 feet with about 206,000 feet of gas showing at 2,667 feet. This company's test on the Thomas Bebout farm is drilling at 800 feet.

In Greene County, the South Penn Oil Co. is building a rig for a No. 9 on the Charles T. Harvey farm in Center Township. In Jefferson Township, the Duquesne Gas Co. is building a rig to deepen the No. 1 on the Davis farm. In Perry Township, the Peoples Natural Gas Co. is down 2,987 feet deepening the No. 1 on the Eli Headley farm.

In Morris Township, Greene County, Burleigh & Wright have completed the rig for a test on the Frank Yoders farm. The Duquesne Gas Co. has a rig standing on the Clutter farm for a test.

In Richhill Township, Greene County, the Natural Gas Co. of West Virginia has spudded in and started drilling the test on the T. H. Holmes farm and has reached a depth of 1,945 feet on the Braddock farm. The Manufacturers Light & Heat Co. is down 795 feet on the Lyons farm, the Pittsburgh Coal being at 675 feet and on the S. S. Leslie farm this company has reached 2,665 feet.

Deep Tests

In Washington County, Norwood Johnston, Jr., and others have completed the rig and will start drilling the deep test on the James McBurney farm in Pleasant Township. It is located about 2 miles south, 25 degrees east, of the school house at the cross roads at Hickory. It is scheduled for the Oriskany sand after extensive seismograph work.

In South Shenango Township, in Crawford County, the test of the Carnegie Natural Gas Co. on the Gertrude Scott farm is progressing slowly with the tools now at 4,282 feet.

In South Union Township, Fayette County, the test of William Snee and others on the Summit Hotel property on Chestnut Ridge is making fair progress and has passed through the Tully lime and is drilling in the Black shale below 6,130 feet.

WEST VIRGINIA

Four producers were completed in West Virginia during the week. In Clay County, the Virginian Gasoline & Oil Corp. completed two wells on the Brown, Swan, Goshorn & Geary tracts in Henry district. The No. 32 was completed in the Injun sand at a depth of 1,990 feet and it is showing for 2 bbls. a day. The No. 33 was completed at 2,035 feet and is good for 4 bbls. a day. These are smaller than usual on this lease.

In Wirt County, J. J. Shore completed a test on the Riley Mayle farm in Clay district in the Mitchell sand at a depth of 452 feet. It is making 10 bbls. a day, initial. In Burning Springs district, Glen W. Roberts completed a test on the F. J. Mills farm in the Keener sand at a depth of 1,985 feet and it is also good for 10 bbls. a day.

In Gilmer County, the Hope Construction & Refining Co. reconditioned the No. 1 on the G. C. Fisher farm in DeKalb district and increased production from 2 to 7 bbls. a day. In the Tanners Run pool, this company shot and cleaned out the No. 1 on the L. L. Atkinson farm and increased production to 4 bbls. a day.

Gas Wells

In Cabell County, another fair gas well was completed. In McComas district, R. H. Adkins and others completed a test on the W. Carter and others lease in the Big Injun sand at a depth of 1,283 feet. It is a gas well gauging 3,700,000 feet a day.

In Calhoun County, F. F. McIntosh and others completed a No. 5 on the C. L. and G. W. Jarvis farm in Washington district in the Big Lime which extended from 1,605-1,735 feet. There was about 212,000 feet of gas, natural, at 1,714-20 feet.

In Lewis County, the Hope Construction & Refining Co. drilled deeper the No. 1,648 on the George W. Rohrbough farm in Court House district to a total depth of 2,916 feet. Drilling commenced at 2,673 feet and the lower sands were dry and the hole is being abandoned. The Gordon sand was at 2,722-39 feet and the Fifth sand at 2,872-87 feet.

In Monongalia County, the Carnegie Natural Gas Co. completed the test on the F. M. Shearer farm in Cass district in the Big Injun sand at a depth of 1,741 feet. It is a gas well gauging 276,000 feet a day.

In Wetzel County, O. T. Mideap and others completed a test on the Henry Elson farm in Green district in the Big Injun sand at a total depth of 2,083 feet. It gauges 554,000 feet a day from that formation.

Other Operations

In Cabell County, there are additional new locations. On Guyandotte River, in McComas district, the Waggoner Gas Co. is setting a machine for a test on the J. D. Bias farm. The Hillcrest Gas Co. has rigged up a second test on the Elsi D. McComas farm. W. C. Kingery and others have reached 1,117 feet on the Pratt heirs No. 3. Pridemore & Adkins are down 1,116 feet in a second test on the Licas heirs farm. The Homer Gas Co. is at 840 feet on the Homer Woodall farm. The Kanawha West Virginia Gas Co. is drilling at 3,100 feet in the R. N. Heath test and 1,220 feet in the W. E. Farley and others test. The West Virginia Gas Co. has started drilling No. 4 on the John J. Porter farm. In Grant district, the Shale Gas Co. is down 2,300 feet on the Mary and Walter Johnson farm. In Guyandotte district, the Merrits Creek Gas Co. has started drilling the test on the David Gideon farm. The National Gas Corp. is down 1,775 feet on the F. L. Whitaker farm.

In Gilmer County, the McCall Drilling Co. has made a location for a test on the E. J. James farm in Center district. In Kanawha County, the United Fuel Gas Co. has made a location for No. 1 on the A. S. Alexander and R. E. McCabe lease on Johns Fork of Little Sandy Creek in Big Sandy district. The Pure Oil Co. is building a rig for No. 262 on the Williams Coal Co. lease.

In Lincoln County, the United Fuel Gas Co. is moving in tools for a No. 4,606 on the James M. Egnor farm. This company is drilling a No. 1 on the Jennie Scites farm on Guyandotte River in Laurel Hill district. The Big Laurel Gas Co. is moving in for No. 3 on the Calloway Plumley farm on Big Laurel Creek in Union district. In Sheridan district, W. C. Kingery and others are drilling at 920 feet on the M. F. Brown farm.

In Pleasants County, Howard McAtee has spudded in and started drilling No. 5 on the W. P. Naish farm in Grant district. In Raleigh County, Godfrey L. Cabot, Inc., is down 3,345 feet in No. 10 on the Beaver Coal Co. tract in Slab Fork district.

In Ritchie County, the Clarvin Oil & Gas Co. has started drilling No. 3 on the W. M. Marbury 900-acre tract in Grant district. It is about 2 miles west of Petroleum. Richards & Moats have made a location for a second test on the Stout & Jackson lease. Toney Elliott and others have started drilling the test on the Roy Freshnour farm in Murphy district.

In Wayne County, V. L. Lusher is moving in for a second test on his

own property in Union district on Beech Fork. The No. 1 is in the sand. The Ceredo Gas & Development Co. has started drilling the test on their property in fee in Ceredo district.

In Upshur County, the Columbian Carbon Co. has reached a depth 1,675 feet in the test on the W. H. Reger farm in Warren district.

In Buchanan County, Virginia, Godfrey L. Cabot, Inc., has resumed drilling the deep test on the National Shawmutt Bank lease after a shutdown for a heavier rig. The present depth is 4,335 feet.

California Fields

(Continued from Page 184)

test showed the water to be fresh, however, and this indicates a possible faulty shutoff. The Javon field, discovered by the Continental Oil Co. last month, is located in Padre Juan Canyon in a monoclinal area between the Red Mountain and San Miguelito faults. It is located approximately midway between the San Miguelito and Rincon fields, but, unlike these two productive areas, the Javon field is located north of the San Miguelito fault, whereas Rincon and San Miguelito are located south of the fault. The surveying party, the expenses of which are being borne jointly by Continental, Chanslor Canfield Midway Oil Co. and the General Petroleum, is expected to complete its assignment within another few days and these companies will therefore be in a position to proceed with additional development. It was found necessary to make a very comprehensive survey of this area in order to definitely determine the corners of each property, as this district is an old Spanish grant and consequently was not surveyed by either the state or federal government.

Deep zone exploration in the Elwood field of Santa Barbara County has been somewhat of a disappointment as the Barnsdall and Rio Grande No. 12 Luton Bell showed every indication of resulting in commercial production in a formation below the Sespe a few months ago. Following an unsuccessful production test, drilling operations were resumed and this well is at the present time rotating ahead below 7,700 feet. The Honolulu Oil Corp. has decided to carry its No. 9 on tideland permit No. 90 down as a deep test. Operators in this field are deepening several wells from the present productive Vaqueros to the underlying Sespe, which has likewise been found productive. The Union Oil Co. is rigging up rotary drilling equipment in No. 1 Sudden, a wildcat, which will be drilled in Santa Barbara County about midway between Point Concepcion and Point Arguello and immediately adjacent to tidewater. This wildcat, which is located on a heretofore untested structure of limited extent, will be spudded in before the close of the month. North of the Casmalia and Santa Maria fields of Santa Barbara County, the Union is rotating ahead in a wildcat on the Adam lease in section 24-10-34.

Kettleman Hills

Two wells were completed in the Kettleman North Dome field although one of these new producers was almost lost by a fire that developed at the last minute. This was Standard Oil Co. No. 58-19-J, which was brought in flowing 870 bbls. of exceptionally clean 35.3 gravity oil and 650,000 feet of gas per day from 8,705 feet, after the hole had been finished with a 5¾-inch liner carrying 253 feet of perforations. After swabbing operations had been started, and before completion, the rig caught fire and the engine house and dog house were burned. This delayed completion for 24 hours but it was subsequently brought in under a natural flow and turned into tanks with no other difficulty. The Kettleman North Dome Association completed its No. 43-28-J in section 28-21-17 and this new well was brought in flowing 1,351 bbls. of clean 34.9 gravity oil per day from 8,517 feet after the hole had been finished with a 4½-inch liner including 187 feet of perforated. Kenda's No. 21-28-J was given a preliminary production test during the early part of the week but a satisfactory shutoff had not been effected and the well was killed in order to recement the 6⅝-inch which had been landed at 7,976 feet. This well was put on gas lift but began flowing within a short time after being kicked over. It flowed for 10 hours at the rate of 650 bbls. per day before being killed.

The Dumas-Lewis Oil Co. has completed its No. 1 in section 6-4-14 in the Torrance field of Los Angeles Basin and this new producer was brought in pumping 241 bbls. of 17.6 gravity oil per day following completion at 3,736 feet after the hole had been finished with a 6⅝-inch liner including 393 feet of perforated. Thomas R. Clark No. 1 in the same section was recompleted last week and is at the present time pumping 149 bbls. of relatively clean 15.5 gravity oil per day from 3,552 feet. These two recent completions will probably lead to the drilling of several new wells but their small initial will not result in any large amount of work. In the Long Beach field, the United Empire Oil Co. finished its No. 5 Signal but this new well was good for only 51 bbls. per day of 22.9 gravity oil from 4,570 feet. This well is producing under a severe handicap, however, as the hole is full of junk below 4,384 feet which is undoubtedly preventing free drainage into the hole.

Rocky Mountain Fields

(Continued from Page 182)

Neil Spencer No. 2 Tweedy, 925 ft. NS line, 1,980 ft. WE line, sec. 25-33n-6w. Cellar (first report).
R. C. Tarrant No. 6 Britton, C SE SW sec. 12-34n-6w. S.D.; rig.
R. C. Tarrant No. 5 Getty, NW NW SW sec. 2-34n-6w. Drlg. 2,530 ft.
R. C. Tarrant No. 2 State, C NE SE sec. 36-34n-6w. S.D. 1,040 ft.; to work on W.W.
R. C. Tarrant No. 7 Haglund, Jr., C SW SW sec. 13-34n-6w. Standing rigged.
R. C. Tarrant No. 2 Reikhoff, SE NE SE sec. 3-34n-6w. Loc. (first report).
Texas Co. No. 5 fee, 660 ft. N of SW cor. sec. 15-35n-6w. T.D. 2,777 ft.; run. 7-in.
Texas Co. No. 1 Marie Jones, C NW SW sec. 6-33n-5w. Bldg. rig (first report).
Texas Co. No. 1 Walker, C NE NE sec. 2-35n-6w. T.D. 2,765 ft.; fishing for tools.
Texas Co. No. 1 Tribal, Lot 4, 1,300 ft. from W line, 200 ft. from S line, sec. 2-33n-5w. Cleaning away snow to build road.
Wilkerson et al No. 1 Tribal, SW SE NE sec. 31-33n-5w. Drlg. 1,845 ft.
Whetstone et al No. 1 Tribal, C SE NW sec. 36-33n-6w. Bldg. rig.

Petroleum County

West Dome Oil Co. No. 1, SW SE NE sec. 9-15n-29e. Drlg. 854 ft.

Judith Basin County

Fletcher E. Hunt No. 3, NW SE NE sec. 30-14n-15e. Drlg. 358 ft.

Pondera County

Wm. M. Fulton No. 1 Price, SW NE NE sec. 18-27-4w. Drlg. 1,250 ft.
Norden Corp., Ltd., No. 1 Hollan, NW SW NW sec. 12-28n-6w. Resuming at 583 ft.

Toole County

One completion was made in the Kevin-Sunburst field in Cook & Eddy No. 1 Heskins, SW cor. section 25-36-2w, which swabbed 45 bbls. initial from the Sunburst sand at 1,513-40 feet. Total depth is 1,544 feet. The will will be shot. All other operations in the field continue to be shut down.

UTAH

Grand County

Columbia Crude Co. No. 1 Rath, SW SE sec. 12-35n-20e. S.D. 135 ft. (corrected).
Utah Southern Oil Co. No. 1 Hyde, SE NW NW sec. 33-22n-22e. Drlg. 2,900 ft.
Glenn Ruby et al No. 1 State, NE SE SE sec. 34-31s-16e. Drlg. 710 ft.

Washington County

Arrowhead Pet. Corp. No. 1-A, SE SW NE sec. 1-43s-15w. Drlg. 2,418 ft.; hole full of water; 6¼-in. at 1,409 ft.

West Texas Fields

(Continued from Page 187)

bbls. Pat Oil Co. No. 4 Nail, total depth 1,541 feet, 70 bbls. Pitzer & West & Humble No. 2 De La Fosse. dry and abandoned at 4,540 feet. Root and others No. 1 Latimer, dry and abandoned at 1,642 feet. Roeser and Pendleton and others No. 1 Swenson, dry and abandoned at 1,977 feet. St. Mary Oil & Gas Co. No. 1 Webb & Daws, dry and abandoned at 1,460 feet. Tannehill and others No. 27 Matthews, total depth 1,155 feet, 35 bbls.

Tannehill and others No. 28 Matthews, total depth 1,146 feet, 35 bbls. Texas Central Oil Co. No. 1 Flippen, dry and abandoned at 1,152 feet. Weona Oil Corp. No. 6 Copeland, total depth 799 feet, 20 bbls. Weona Oil Corp. No. 7 Copeland, dry and abandoned at 820 feet.

Stephens County

Mid-Tex. Oil Co. No. 2 Cunningham, total depth 3,986 feet, plugged back to 3,270 feet, 5 bbls. Shertzer Brothers No. 26 Stuart Brothers, total depth 1,745 feet, 20 bbls.

Throckmorton County

Bearman Oil Co. No. 6 Ledbetter, total depth 787 feet, 35 bbls.

PANHANDLE COMPLETIONS

Completions in the Panhandle district with their top of sand record and total depth, and initial production were as follows:

Carson County

Magnolia Petroleum Co. No. 16 fee No. 244, 2,957-2,992 feet, 571 bbls., pumping; shot with 200 quarts.

Gray County

Empire Gas & Fuel Co. No. 5 Cunningham, 3,250-3,308 feet, 707 bbls., pumping; shot with 400 quarts. Jones No. 4 Culler, 3,180-3,305 feet, 714 bbls., pumping. King Royalty Co. No. 7 S. Volmert, 3,170-3,260 feet, 460 bbls., pumping; shot with 420 quarts. W. J. and John Moran No. 2 Skidmore, 3,140-3,300 feet, 514 bbls. pumping; shot with 600 quarts. Ryan Consolidated No. 1 Barrett, 3,249-3,297 feet, 421 bbls. pumping.

Moore County

Texhoma Natural Gas Co. No. 2 Terry Thompson, 2,775-3,365 feet, plugged back to 3,335 feet, 38,400 000 feet gas.

Wheeler County

Danciger Oil & Refining Co. No. 2 Massey, 2,030-2,168 feet, 51,600,000 feet gas. Skelly Oil Co. No. 13 Johnson, 2,390-2,526 feet, 1,246 bbls., flowing.

Hutchinson County

J. E. Crosbie No. 10 Pitts, 2,865-2,963 feet, 693 bbls., pumping. McIlroy Oil Co. No. 1 Starnes "A", 3,085-3,127 feet, 325 bbls., pumping. Skelly and Cabot No. 2 W. E. Herring, 2,685-3,161 feet, plugged back to 2,986 feet, 15,580,000 feet gas; shot with 295 quarts. Turman & Plains Oil Co. No. 4 J. A. Whittenburg, 2,880-2,927 feet, 668 bbls., pumping; shot with 450 quarts.

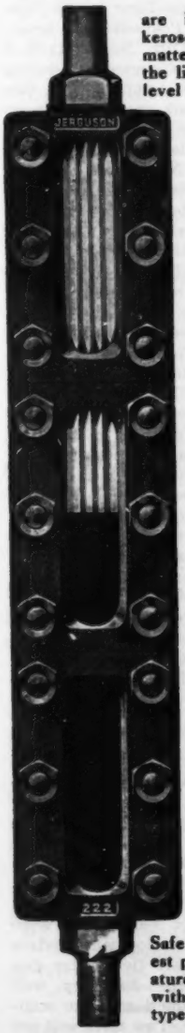
Spacing Law Suit

AUSTIN, Tex., Mar. 16.—Three cases involving railroad commission exceptions to Rule 37, fixing spacing limits, were reversed by the Third Court of Civil Appeals and judgments rendered that the permits were invalid. Stanolind Oil & Gas Co. was the contestant and the commission was defeated in each case and joined separately by the permittees, J. Jackson, J. C. Sanford and Overton Refining Co., respectively.

Views expressed in the three cases are similar to those by the Supreme Court in deciding the Brown vs. Humble company case, holding drainage must be permitted from under adjacent lands. In one case decided the Brown case was cited as showing vested rights had been recognized and protected in a permit for a nearby well on tracts under common ownership.

JERGUSON

REFLEX GAGES



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Southwest Texas District

AUSTIN CHALK IN PEARSALL YIELDS 2 MORE PRODUCERS

By GEORGE WEBER

SAN ANTONIO, Tex., Mar. 16.—Wildcatting and field activity continued evenly distributed through most of Southwest Texas during the past week, with Frio County still commanding much of the interest of operators.

Fields in Nueces and San Patricio Counties saw considerable development, as activity increased in the Saxet Heights and Saxet fields and a new producing horizon was brought into production in the Taft field. One of the two wildcats drilling in Brooks County shows promise of opening the first production in that county. The Laredo district continued most active of the four areas in this section, with Loma Novia, Seven Sisters and Lopez leading in volume of completions and drilling rigs.

The interest attending the completion of a large producer in the Austin Chalk in the Pearsall field, Amerada Petroleum Corp. No. 6 Halff & Oppenheimer, was augmented during the week by the completion of two other Austin Chalk producers. Amerada, which is the sole operating company in this field, holding 85,000 acres, completed No. 5 Half & Oppenheimer in the Austin Chalk bottomed at 5,465 feet. The well was treated with acid after which it was brought in making an initial of 800 bbls. per day. No. 1 MacWilliams, on Tract 13, was shot and recompleted making nearly 7,800 bbls per day. Two new tests were started in the field, No. 1 Kothman and No. 7 Halff & Oppenheimer, both in the northeast section of the field. The No. 1 Kothman was abandoned last year but will be deepened. Three are drilling on the Correy & MacWilliams leases to the southwest. The company is laying additional field lines and building storage at Melon to care for the new production recently brought in.

Due to the size of the Amerada block, the usual entry of other operators into the development of the area is absent. However, the discovery of such sizeable production is expected to revive interest of operators holding acreage in the Fault Line area and result in further exploration.

Taft Field

The production from a new sand in the Taft field of San Patricio County indicated last week in Humble Oil & Refining Co. No. 1 Mayo was realized, as the well was completed gauging 24.87 bbls. the first hour on a three-eighths-inch choke. Tubing pressure of 420 pounds and casing pressure of 440 pounds were recorded. This development revives interest in the Taft field after two tests offsetting the discovery well failed to find production in the original 4,900-foot pay. Two tests will get under way shortly in this area, Esmes Oil Co. No. 3 Britton, a south offset to the discovery well, and Shell Petroleum Corp. No. 1 Pullin, a southwest offset. These two locations complete the ring of tests surrounding the original well, and are expected to reveal much as to the direction and size of production in the new field.

In the same county, one completion was made in the Plymouth field and five other wells were on the sand; four of them being drilled for the Plymouth Oil Co., and the fifth for Sun Oil Co. in the southern part of the field.

Nueces County

Nueces County activity centered in the Saxet and Saxet Heights fields, where drilling has reached the boom stage. New extensions added and indicated in the latter field have given rise to the staking of many new locations for tests, and indications point to the development of the new field to the edge of Nueces Bay to the north, and to the city limits of Corpus Christi on the east. Five producers were added to the Saxet Heights field as a result of the week's drilling, and the volume of new tests starting assures a continuance of the rate of development this field has enjoyed since its discovery. The sand in which production is found is relatively thin, however, and a few operators have encountered trouble due to completions in the water sand. Fields of the lower Coastal region have found pay in many underlying sands, and additional horizons may be found in that area. A test is now drilling below 4,300 feet to explore these possibilities. It is Tom Graham No. 1 Whelan, on the north edge of the field.

The Clarkwood area of the Saxet field is also getting much concentrated play, several offset rigs are now drilling. Two completions were made in the Clarkwood townsite during the week, and others are due for early completion.

An extensive area in Nueces and San Patricio Counties is being explored by wildcats and the section is being carefully watched as they progress.

Duval County

Six completions were made in the Seven Sisters field in northern Duval County; all producing from the Government Wells sand. One test, Santa Clara Oil Co. No. 25 Welder in Survey 383 was temporarily abandoned after it started flowing water from a shallow sand. The well will be used as a supply for water for the time being. Its abandonment has no bearing on the producing sand at that location.

Six rigs are drilling in the Hoffman field. One test, Duval Oil Corp. No. 1 D. Ruiz in Survey 119, was plugged back to the gas sand at 2,685 feet and completed as a gasser.

In the Hagist area near the Eagle Hill field west of Seven Sisters, the Marzo Oil Co. No. 2 Hagist will core to the Loma Novia and Mirando sands, it was reported. The test has had a show at the 2,100 feet sand in which No. 1 Hagist found production, but could not successfully complete for production.

Loma Novia

The bulk of new producers added to Southwest Texas, and the center of most of the drilling continued in the Laredo district, more specifically the Loma Novia field. Here a number of proven leases are being drilled. Greatest importance in the operations on inside locations lies in the volume of activity. During the past week 16 wells were completed. Due to the ease of drilling, absence of great pressures, and relatively shallow production as compared with other fields, drilling time is short, often less than two weeks. The principal difficulty is an adequate supply of water.

Webb County

In Webb County rigs are drilling in three fields, Lopez, O'Hern and Cole. In Lopez six completions were reported, with initials ranging up to 30 bbls. per hour. Since the opening of the south extension to this field, operations have steadily increased and several new operators have been added. Latest newcomer is Luling Oil & Gas Co., which is mvoing in on a location on the north edge of production.

At the latest report, the wild well of Houston Oil Co., No. 33 Cartwright in the Mount Lucas gas field of Live Oak County, was still defying efforts to kill it. The well has been burning for more than a week, and has cratered.

The new field indicated by Dick Young No. 1 Singer in Brooks County has been officially named the Alta Verde. The wildcat was standing with 600 feet of oil in the hole with sand at 917-919 feet.

Samfordyce Extended

A 1,500-foot west extension to the Samfordyce field in Hidalgo and Starr Counties in the lower Rio Grande Valley is seen in the Sun Oil Co. No. 1 Chapotala Land Co., that company's first operation in the field. The outpost well filled 550 feet with pipe line oil in four and one-half minutes and has set casing at 2,810 feet. In eastern Hidalgo County, Union Sulphur Co. No. 7 American Rio Grande was cleaning to make the fifth producer in the Mercedes field deepest in Southwest Texas. Wildcatting continued strong in Hidalgo County, with several approaching contract depths. No shows have been reported to date.

In Edwards County, Paul Teas No. 1 Stewart is drilling below 2,800 feet and making about 100 feet a day. This is the only active deep test in the Edwards Plateau of this section at the present time.

Southwest Texas completions of the past week and the detailed drilling report will be found in the section devoted to drilling operations on pages 195 to 204.

Canadian Fields

CHATHAM, Ontario, Mar. 14.—Deliveries to Calgary refineries from the Turner Valley field in February totaled 74,146 bbls., against 79,127 bbls. in January and the monthly average in 1935 of 80,710 bbls. Deliveries to the Bell Refining Co. dropped from 9,941 to 8,953 bbls.; and deliveries to Imperial Oil Refineries, Ltd. from 69,186 to 65,193 bbls. The shorter month and severe weather conditions both contributed to the lower totals.

North Turner Valley

In the North Turner Valley field, Model Oils No. 3, LSD 1, section 22-20-3w5, bottoming in the Madison lime at 6,240 feet, has been cleaned out to below 6,000 feet, and is producing about 10 bbls. a day of clear white naphtha. Cleaning out is being continued. Farther east, Royalite Oil Co. No. 27, LSD 4, section 23-20-3w5, is nearly 200 feet in the lime at 5,393 feet after setting casing at 5,212 feet. It has some wet gas but will deepen before testing production.

South Turner Valley

In section 28-18-2w5, South Turner Valley, British Dominion Oil & Development Corp. No. 4, LSD 6, has resumed deepening in the lime from 6,325 feet. While drilling it will continue to take naphtha recovery, which in February averaged better than 100 bbls. a day. Farther south, Renfrew Royalties No. 1 Morris & Goodfellow, LSD 3, same section, has resumed from 6,020 feet where casing was set in the top of the Madison limestone. In the northwest corner of the same section, Turner Valley Royalties No. 1, LSD 13, offsetting Century Royalties No. 1 producer to the west, is below 4,300 feet and getting the customary markers. It is the most westerly test on this portion of the Turner Valley structure.

In section 21-18-2w5, Union-Freehold Oil Corp. No. 1, LSD 8, is still clearing rotary water and shows a little increase in gas flow. Farther south, Highwood-Sarcee Oils No. 2, LSD 1, same section, is deepening from 2,307 feet after changing to rotary tools.

In the same section, Highwood Royalties No. 1, LSD 3, has resumed from 2,460 feet after a shut down of about a year. It is the farthest south and west location in the section, and a couple of miles west of Highwood-Sarcee No. 2.

WILDCAT OPERATIONS

OKLAHOMA WILDCATS

Week Ending March 14

NORTHERN OKLAHOMA

Alfalfa County

Tex-O-Kan. Oil Co. No. 1 Acre, C SW NE sec. 14-24-11w. Sylvan shale 7,065 ft.; Wilcox sand 7,259 ft.; Schlumberger test showed porosity at 5,910 ft. and at 6,400-6,500 ft.; T.D. 7,325 ft.; lost circulation.

Beckham County

Carter Oil Co. No. 1 Davidson, C NW SW sec. 2-9-25w. Location.

Wood Pet. & Royalty Corp. No. 1 Blair, C NW SE sec. 32-9-26w. Drlg. 2,374 ft.

Caddo County

Denver Prod. & Ref. Co. No. 1 Sah-Can. C SE SE sec. 32-10-10w. Swabbing below 6,000 ft.; produced 200 bbls. oil in three days.

H. W. Lee et al No. 1 Horton, NE cor. Sec. 9-6-3w. S.D. at 2,001 ft.

Cleveland County

Hall-Briscoe, Inc. No. 1 Fant, S.7 SW NE sec. 27-10-2w. S.D. at 7,511 ft.

Coal County

Shell Pet. Corp. No. 3 Hill, SE SE NW sec. 30-3-10. Sand 1,520 ft.; McAllister series 1,600 ft.; Atoka shale 2,380 ft.; drlg. 4,435 ft.

Comanche County

N. E. Milling No. 1 Miller, NE NE SW sec. 23-4-12w. Drlg. 690 ft.

Geo. Pace et al No. 1 Spencer, SW cor. SE sec. 21-3-10w. T.D. 4,164 ft. in Granite wash; P.B. to 1,850 ft.; re-cmtd. hole from 1,853 ft. to 1,634 ft.; drlg. cmt. to 1,813 ft.; S.D.

Garfield County

Herndon Drlg. Co. et al No. 1 Branson, SW SW SE sec. 23-24-3w. T.D. 4,110 ft.; rotary pipe stuck.

W. J. Sherry et al No. 1 Haken, NW NW SW sec. 32-20-10w. Layton 4,820 ft.; Oswego 5,585 ft.; drlg. 5,680 ft.

Stanolind O. & G. Co. et al No. 1 Brunken, SW SW NE sec. 32-23-4w. Drlg. 4,212 ft.

Garvin County

Chas. E. Carter et al No. 1 Wood, NW SW SE sec. 5-4-3.
Old T.D. 2,405 ft.; to deepen.

Suggett & McElreath No. 1 Hyre, NE NE SE sec. 23-3-1w. Drlg. 4,367 ft.

Hughes County

Brady Oil Co. No. 1 Culver, NE SE NW Sec. 28-7-9. Location.

W. P. Canavan No. 1 Meadors, SE NE SE sec. 5-8-10. Gilcrease 2,600 ft.; Wapanucka 3,050 ft.; Cromwell 3,058 ft.; sands 3,130 ft. and 3,180 ft.; slight showing of oil; T.D. 3,196 ft.; P.B. 3,168 ft.; shot; bailing.

Fitzpatrick et al No. 1 Cotton, SE SE NE sec. 13-8-8. Bldg. rig.

M. H. Halsey No. 1-A Eustep, NW NW SW sec. 11-8-9.
Wapanucka 3,428 ft.; Cromwell 3,462 ft.; T.D. 3,464 ft.; 2 bailers wtr. an hr.; P.B. and shot, 3,030-45 ft.; est. 10,000,000 ft. of gas; P.B. to 3,412 ft.; re-shot.

Phillips Pet. Co. No. 1 Eberle, NE NE SW sec. 12-5-9. Drlg. 1,470 ft.

Schumacher et al No. 1 Schumacher, NE NW NE sec. 23-5-10. T.D. 1,730 ft.; S.D.

Sivalls et al No. 1 Montgomery, NW SW NW sec. 7-9-9. Drlg. 2,110 ft.

Kay County

Black Gold Pet. Co. No. 1 Cooley, NE NW SW sec. 25-28-4e. Sand 1,395-1,460 ft.; T.D. 1,535 ft.; 8-in. casing collapsed.

Kiowa County

Burns & Moore's No. 1 Webster, C NE NE sec. 2-6-17w.
Sand showing oil at 450-53 ft. and 456-58 ft.; T.D.; pumped 22 bbls. in 4 hrs.; machine moved out.

W. C. Adams et al No. 2-A Stone, C SE SE NE sec. 34-7-17w.
T.D. 1,193 ft.; machine moved out.

J. C. Shaffer et al No. 1 Slusher, NW SW NW sec. 35-7-17w. T.D. 1,055 ft.; est. good for 5 bbls.; P.B. to 955 ft.

Lincoln County

Fred McDuff's No. 1 Jacob, NE NE SE sec. 10-15-5. First Wilcox sand 4,305 ft.; second Wilcox 4,328-45 ft.; T.D.; dry and abd.

Stanolind O. & G. Co. and Amerada Pet. Corp. No. 1 Crawford, NE NE SE Sec. 35-15-2. First Wilcox 5,110 ft.; second Wilcox 5,218 ft.; T.D. 5,229 ft.; flowed 131 bbls. in 10 hrs., 20% water and mud; 1 bbl. fluid per hr.; 1,000,000 ft. gas; acidizing.

Logan County

R. H. Pierce No. 1 Kihega, SW cor. sec. 7-17-1. Drlg. 4,864 ft.

Stanolind O. & G. Co., Amerada Pet. Corp. and Eason O. & R. Co. No. 1 Gragg, SW SW NE sec. 20-18-4w. Cored 6,063 to 6,122 ft.; showing oil and gas, to test.

McClain County

Arab Pet. Corp. No. 1 Autry, NW cor. sec. 16-7-3w. T.D. 8,019 ft.; S.D.

McIntosh County

Indian Ty. Ill. Oil Co.'s No. 1 Tancred. 1,050 ft. S and 390 ft. E of C. Sec. 9-9-14. Gilcrease sand, 2,695-2,732 ft.; 20,000,000 ft. of gas; Cromwell 3,608 ft.; show of water 3,616 ft.; T.D. 3,628 ft.; reaming.

Oklahoma Oil Corp. No. 1-A Wolf, SE SW SE sec. 35-12-17.
Gas sand 800 ft.; dry sands 1,200 ft. and 1,400 ft.; drlg. 1,800 ft.

Noble County

Continental Oil Co. No. 1 Pruitt, NW SE SW sec. 19-20-1w. Rigging up rotary.

Okfuskee County

Manahan & Grisso No. 1 Dalton, SE SE SE sec. 36-16-8.
Senora sand 1,723 ft.; T.D. 1,763 ft.; flowed 75 bbls. oil first hour after shot; flowed 225 bbls. in 7 hrs., and 203 bbls. in 9 hrs.; lost 4 hrs. while cleaning out.

W. J. Sherry et al No. 1 Washington, SW SW NE sec. 21-13-7.
P.B. 4,130 ft.; acidized; gas estimated 50,000 ft.; re-acidized; gas 9,800,000 ft.; completed; shut in.

Oklahoma County

H. R. Hollenback et al No. 1 Cooper, NW NW NE sec. 15-11-1. Rigging up rotary.

Sinclair Prairie O. & G. Co. No. 1 Corbett, NE NW NE sec. 17-13-3w.
Washed clean and acidized; flowed 17½ bbls. "gasoline" and 3,000,000 ft. of gas in 24 hrs.; T.D. 6,547 ft.

Osage County

Elfred Beck No. 1 Osage, SE SE NE sec. 6-23-7. Location.

Payne County

Denver Producing & Ref. Co. et al No. 1 Pratt, NW cor. sec. 20-18-3. Moving in tools.

Pittsburg County

Vaughn Prod. Co. et al No. 1 Chunn, 990 ft. N and 614 ft. W of C sec. 29-4-14.
S.D. 1,170 ft.; recovered all drill pipe; tools moved out.

Pontotoc County

Gulf Oil Corp. No. 1 Emry, SW SW NE sec. 15-2-6. Red granite 6,574 ft.; T.D. 6,600 ft.; S.D.

Mid-Texas Pet. Co. No. 1 Whitney, SW SW SE sec. 30-5-4. T.D. 1,946 ft.; waiting on cement.

Pioneer O. & G. Co. No. 1 Bayne, SE SW SW sec. 16-5-6 (old well deepening).
T.D. 3,016 ft.; P.B. to 3,006 ft.; acidized and no results; P.B. to 2,760 ft.; 1,600 ft. of oil in hole; pumped .7 bbls. in 24 hrs.; completed.

Pottawatomie County

Ross Oil Co. et al No. 1 Sparkman, SE NE sec. 33-8n-4e.
C.O. 3,915 ft.; shot at 3,871-90 ft.; swbd. 250 bbls. in 24 hrs.; acidized.

Roger Mills County

Anderson & Kerr et al No. 1 Tester, C SE SE sec. 2-17-25w. Panhandle Big lime 4,195-6,503 ft.; T.D.; dry and abd.

Seminole County

Amerada Pet. Corp. et al No. 1 Community, NE NE SW sec. 3-10-5. Drlg. 1,788 ft.

Imperial Drlg. Co. No. 1 Aldridge, SW NE NW sec. 32-9-8. Rig.

Sinclair Prairie Oil Co. et al No. 1 Harrison, NE NE NW Sec. 17-8-8.
Location.

Felmlee & Nichaelson No. 1 Belford, SE NW NE sec. 15-9-8.
Sand 1,460-1,505 ft.; showing oil and gas; S.D. 1,680 ft.

Washita County

L. P. McWhirter's No. 1 fee, SW cor. Sec. 34-8n-19w. Drlg. 1,380 ft.

SOUTHERN OKLAHOMA

Atoka County

Phelps & Coats et al No. 1 Fidelity Life Ins. Co., SE SW NW sec. 23-1s-12. Drlg. 465 ft.

Vierson et al's No. 1 Williams NE SW NW sec. 34-2s-10. Produced 2,500,000 ft. of gas from 3,746-48 ft.; now dead; set 6-in. csg. 3,759 ft.; T.D. 3,935 ft.; underreaming.

Bryan County

Wayne King No. 1 Kimbell, C E½ NE NW sec. 36-9s-9e. Sand 869-870 ft.; T.D.; waiting for casing.

Carter County

Carter Oil Co.'s No. 1 Carter-Willis SW NE SW sec. 27-2s-3w. T.D. 8,088 ft., flowed 10,000 bbls. of oil in 24 hrs.; drlg. 7,970 ft. in new hole.

Carter Oil Co. et al No. 1 Leon Voorhees. C SE SW sec. 34-5s-2w. Rigging up rotary.

Southern States Oil Dev. Co. No. 1 Moore. NE SE NW sec. 30-4s-1w. S.D. 1,155 ft.

Texas Co. No. 1 Cathey, SE NE NE sec. 6-5s-1w. T.D. 4,164 ft.; pumped 85 bbls. in 6 hrs.; 85 bbls. in 8 hrs.; 45 bbls. in 8 hrs.; cleaning out.

Cotton County

Grace & Woods No. 1 Henderson, NE SE SW sec. 27-4s-11w.
Drlg. 1,388 ft.

Harmon County

Lloalko Trust, Ltd. No. 1 Crosnoe, SE SE SW sec. 14-3n-25w.
Location.

Jackson County

C. P. Burnham No. 1 Oliver, NW NW SE sec. 26-1-20w. Drlg. 150 ft.

A. H. Jackman No. 1 fee, SW SW SW sec. 27-1s-24w. Drlg. 2,185 ft.

H. W. Lee No. 1 Wright, NE NW SE sec. 19-1-19w. Location.

Universal Oil Co. No. 1 R. W. Briscoe NW SW NE sec. 36-1s-20w. S.D. 1,550 ft.

Jefferson County

A. T. Campbell No. 1 Trout, SE NE NE sec. 6-8s-7w. Show oil and gas 1,150-55 ft.; drlg. 1,536 ft.

L. C. Hydrick No. 1 Peoples National Bank, SW SW SW sec. 26-6s-5w.
Location.

Geo. Pace No. 1 Gardner, SW cor. Sec. 23-5s-5w. T.D. 1,903 ft.; cleaning out.

Sinclair Prairie Oil Co. No. 1 M. H. Barrett, NW cor. sec. 31-5s-6w. Top Arbuckle lime 3,668 ft.; drlg. 4,010 ft.

Johnston County

Equitable O. & G. Co. No. 1 Bellsey, NE SW sec. 12-2s-4e.
Arbuckle lime 1,552 ft.; drlg. 1,938 ft. in lime.

Magnolia Pet. Co. No. 1 Welch, NE cor. sec. 12-2s-7. Location.

Moore & Wirick No. 1 Westheimer & Daube, SE NW NE sec. 19-3s-4e.
T.D. 1,925 ft.; S.D. for orders.

Le Flore County

McCraw et al No. 1 Tidwell, C NW SE sec. 17-3n-22.
T.D. 1,555 ft.; S.D.

Love County

Amerada Pet. Corp.'s No. 1-A Westheimer & Daube, SW SE SW sec. 27-6s-2e. T.D. 6,797 ft.; to set 10-in. csg. to top of Viola at 2,427 ft.

J. B. Russell et al No. 1 Scott, SW SE SW sec. 29-8s-2e. Drlg. 4,040 ft.

Sinclair Prairie Oil Co.'s No. 1 Stockt SE SE SW sec. 26-6s-2w. T.D. 6,914 ft.; sand 6,898-6,914 ft.; set 7-in. 6,893 ft.

Marshall County

Norman Smith No. 1 Chestnut, NE cor. sec. 23-3s-5e.
T.D. 390 ft.; S.D. for csg.

Pushmataha County

C. W. Whitehead et al No. 1 Misser, SE SW SW sec. 35-3s-18e.
S.D. 3,560 ft.

Stephens County

W. G. Endicott et al No. 1 McFatridge. NW NW SW sec. 11-3s-5w. T.D. 795 ft.; S.D.

Clyde Rhodes et al No. 1-A Doak, SW SW SW sec. 1-1s-5w. T.D. 1,514 ft.; S.D.

Tillman County

Gulf Oil Corp. No. 1 Wearmouth, SE NW SE sec. 31-1s-18w. Set 7-in. csg. 3,271 ft.; T.D. 3,395 ft.

KANSAS WILDCATS

Week Ending March 14

(Descriptions are East unless marked otherwise)

Barton County

Arch E. Merriam No. 1 Soeken, SW SW SE sec. 21-17-11w. Drlg. 300 ft.

Buchanan & Alexander No. 1 Langfeld. NE NE SW sec. 14-20-11w. S.D. 2,020 ft.

Hilligoss et al No. 1 Schmidt, NE cor. sec. 27-19-11w. Drlg. 2,190 ft.

George W. Hinkle No. 1 Smith, SW NW NW sec. 1-17-11w. Drlg. 1,260 ft.

Morgan & Flynn et al No. 1 Amerine, NE cor. sec. 14-19-14w. Drlg. 3,528 ft.

Morgan & Flynn et al No. 1 Zimmer, SW SE SW sec. 20-19-14w. Underreaming 10-inch casing, 2,306 ft.

Murphy & Morgan No. 1 Robinson, NE NE SW sec. 21-16-14w. Drlg. 1,600 ft.

National Ref. Co. No. 1 McLean, SW SW SE sec. 25-17-11w.
Location.

Roy Ramsey et al No. 1 Hunt, NW cor. sec. 10-18-11w. Drlg. 685 ft.

Simpson & Noble and Atlantic Oil Producing Co. No. 1 Hiss, C NW NE sec. 31-20-13w. Rigging up rotary.

Torry & Feaster No. 1 Kimpler, SE NE NE sec. 31-18-11w. Siliceous 3,423-41 ft.; T.D. 3,468 ft.; P.B. to 3,462 ft.; cmtd. 6-in. csg. 3,417 ft.; shot with 40 qts.; no result; D.&A.

Torry & Feaster No. 1 Feist, NE NE SE sec. 29-18-11w. Siliceous lime 3,430-32½ ft.; T.D.; potential; pumped 246 bbls. oil in 18½ hrs.

Wakefield & Johnson No. 1 Bumm, SW SW NE sec. 22-19-12w. Rigging up.

Cowley County

Craft et al No. 1 Taylor, NE SE NW sec. 32-32-3. Rig.

Craft et al No. 1 Whitson, NE NE NE sec. 20-33-4. Spudded and S.D.

Mead Bros. et al No. 1 Orr, SE SE SW sec. 23-31-4. Drlg. 675 ft.

D. D. Mickieson et al No. 1 Wallace, SW SE SE sec. 10-33-4. M.I.M.

A. D. Morton et al No. 1 Roger, SE SE NE sec. 1-31-4. R.U.

Penwest Oil Co. No. 1 Clover, NE SE SE sec. 8-31-7. 19,000,000 ft. gas 1,430-60 ft.; showing oil and gas 2,249-51 ft.; slight showing oil 2,795 ft. Drlg. 3,035 ft.

Roth & Faurot No. 1 Guthrie, NW cor. Lot 14, sec. 30-32-3. Drlg. 2,050 ft.

Roth & Faurot No. 1 Sherwood, NE NW SW sec. 11-31-4. Sand 3,010-29 ft. (cor.); T.D. 3,031 ft.; 2,600 ft. oil in hole; shot with 40 qts.; made potential of 215 bbls. of oil; completed.

A. M. Scroggin No. 1 Brady Est., NE NE SE sec. 30-31-2. Rig.

E. B. Shawver et al No. 1 Wilson, S½ NE SE NE sec. 11-30-4. Set 10-inch casing, 1,695 ft.; fishing.

Shawver & Wilt No. 1 Baruth, SW NW NE sec. 8-34-3. Old well deepening from 1,893 ft.; set 8-inch pipe, 2,763 ft.

Earl Wakefield No. 1 Wilson, NW cor. sec. 4-32-3. Drlg. 900 ft.

Ellis County

Blackwell O. & G. Co. No. 1 Solomon, SE SE SW sec. 28-11-19w. Rigging up.

Bridgeport Machine Co. et al No. 1 Madden Est., NE NW NW sec. 26-15-18w. Moving in material.

Brunson & Ewers-Simpson No. 1 Gross, NE NE SW sec. 29-14-17w. Building rig.

Carlo Oil & Gas et al No. 1 Walter, SE NE SW sec. 2-12-18w. Drlg. 785 ft.

Parrish & Denman No. 1 Walter, SE SW SE sec. 14-13-17w. M.I.M.

Twin Drlg. Co. No. 1 Reidel, SW SW NE sec. 27-12-16w. Drlg. 1,343 ft.

Ellsworth County

Empire O. & R. Co. et al No. 1 Kroesch, NW NW SE sec. 33-17-9w. Rig.

Skiles et al No. 1 Kafka, NE NE SW sec. 15-17-8w. Drlg. 545 ft.

Smith & Ash and Phillips Pet. Co. No. 1 Splitter, SW cor. sec. 19-17-9w. Drlg. 3,076 ft.

Harper County

Marathon Oil Co. No. 1 Zellers, C SW NW sec. 17-35-8w. Fshg. 5,009 ft.

Harvey County

Empire O. & R. Co. et al No. 1 Webster, SE SE SW sec. 8-24-2w. Drlg. 3,400 ft.

Harburney Oil Co. No. 1 Schrag, NW NW SE sec. 24-22-3w. Drlg. 3,060 ft.

Western Kansas O. & R. Co. No. 1 Warkentin, C SW SW sec. 1-23-2w. Drlg. 2,115 ft.

Haskell County

Helmerich & Payne et al No. 1 Larson, C SE sec. 28-28-33w. Rig.

Kuhn Brothers et al No. 1 Nilson, SW SW SE sec. 21-28-32w. Rig.

Kearny County

L. F. Meyers et al No. 1 Beaty, C NW sec. 28-25-36w. Rotary rig.

Kingman County

D. R. Lauck et al No. 1 Skilling, C E½ E½ SW sec. 33-27-8w. O.W.D.D.; drlg. 4,583 ft.

Marion County

Milton et al No. 1 Young, NW NW SE sec. 17-21-3. Drlg. 2,400 ft.

McPherson County

Ok-Tex et al No. 1 Moehlinger, SE SW SW sec. 21-21-2w. Drlg. 2,088 ft.

Ness County

Continental Oil Co. No. 1 Holcomb, 1,320 ft. from N and 440 ft. from E lines of NW¼ sec. 26-11-23w. Drlg. 1,367 ft.

Norton County

Lario O. & G. Co. and Elwell No. 1 Kes-

nedy, SW SW NW sec. 22-3-23w. Drlg. 3,646 ft.

Pratt County

Larlo O. & G. Co., Ewell and Atlantic O P. Co. No. 1 Lemon. SE SE NW Sec 12-29-13w. Simpson 4,606 ft.; Siliceous 4,699-4,728 ft.; T.D.; D.&A.

Reno County

Dickey Oil Co. No. 1-A Shepherd, NE NE NW sec. 22-26-9w. Spudded.

Helmerich & Payne et al No. 1 Schwaiger, SW SE NE sec. 27-26-5w. Drlg. 2,090 ft.

McPherson Drlg. Co. et al No. 1 Miller, SE SE NE sec. 23-24-5w. Drlg. 2,303 ft.

Rice County

Joe Aylward et al No. 1 Oberle, SE SE SW sec. 19-18-10w. Drlg. 690 ft.

Continental Oil Co. and Empire Oil & Ref. Co. No. 1 Nickel, NE SW SW sec. 18-18-8w. Siliceous lime 3,210 ft.; T.D. 3,214 ft.; 2,500 ft. oil in hole; no test.

Day No. 1 Mason. NW NE NE Sec. 28-21-7w. Chat 3,385-3,400 ft.; flowed 91 bbls. in 50 minutes; shut in 2 hrs., flowed 3 bbls. oil in 10 minutes.

Dickey Oil Co. and Continental Oil Co. No. 1 Newkirk, NE NE SW sec. 11-18-7w; location.

Duwe & Schneider No. 1 Wright, NE cor. sec. 36-21-7w. Drlg. 150 ft.

Glimac Oil Co. No. 1 Sargent, SE cor. sec. 21-18-6w. Rig.

Grattan et al No. 1 Williams, SW SW NW sec. 17-18-7w. Drlg. 2,500 ft.

Gulf Oil Corp. No. 1 Steckel, SW cor. sec. 30-19-10w.
Set 10-in. csg. 150 ft.

C. E. Skiles et al No. 1 Edwards, NW NW NE Sec. 3-18-8w.
Siliceous 3,278-81 ft.; T.D.; potential production 550 bbls. of oil in 24 hrs.; deepened to 3,282 ft.; pumped 180 bbls. in 3½ hrs.

Vernon Oil & Gas and Cusco Oil Co. No. 1 Boldt, NW SW NW sec. 10-19-10w. Drlg. 2,985 ft.

W. E. Witt No. 1 Hill, SE SE NW sec. 3-20-9w. Drlg. 365 ft.

Rooks County

Murfin et al No. 1 Wasthusin, NE NE SE sec. 19-9-16w. Drlg. 1,450 ft.

Pryor & Lockhart's No. 1 Bradley, SW SW NE sec. 31-10-16w. Oswald 3,166 ft.; showing of oil 3,157 ft.; underreaming 8-inch.

Skaer Oil Corp. et al No. 1 Dryden, NE cor. sec. 28-10-17w.
Moving in material.

Rush County

Boyle & Grossman No. 1 Wilson, NE cor. sec. 32-17-19w. Rigging up.

Ira Keith et al No. 1 Dartmouth Savings Bank, SW SW NE sec. 3-17-18w. Drlg. 1,575 ft.

National Refining Co. No. 1 Werth, NW NE NE sec. 7-16-18w. Building rig.

Pryor & Lockhart et al No. 1 Stegman, SW NW NE sec. 11-16-17w.
Location.

Rose Spring Drlg. Co. et al No. 1 Jacobs, SW SE NW sec. 8-16-17w. Rigging up.

Russell County

R. G. Berry et al No. 1 Cook, NE NE SE sec. 19-11-12w. Drlg. 625 ft.

Bridgeport Machine Co. et al No. 1 Wyckoff, SE NW NE sec. 27-11-13w. Drlg. 2,425 ft.

Coralena Oil Co. No. 1 Disken. SE cor. sec. 30-15-12w. Oswald 2,900 ft.; water; 2,175-80 ft.

Darby Petroleum Corp. and Continental Oil Co. No. 1 Letsch, SE NE NW sec. 34-14-13w. Building rig.

Eisenhour & Shaffer No. 1 Humes, SW SW SW sec. 6-14-12w. Shut down, 810 ft.

Empire O. & R. et al No. 1 Major, SE cor sec. 11-14-12w. Underreaming pipe, 2,200 ft.

Hartman and Blair No. 1 Boxberger "B," NE SE SW sec. 5-14-14w. Siliceous lime 3,341-42 ft., T.D.; hole full water; dry and abandoned.

Hartman & Blair et al No. 1 Boxberger NW NW SW sec. 32-13-14w. Topeka lime 2,760 ft.; Oswald 3,039 ft.; T.D. 3,220 ft.; bailed 8 bbls. oil per hour; acidized; pumped 192 bbls. oil in 7½ hrs.; cmtd. 6-in. 3,150 ft.

Sam Murphy et al's No. 1 Enschutz & Schaffer, SW cor. sec. 10-15-13w. Siliceous 3,311 ft.; T.D. 3,323 ft.; 500 ft. oil in hole; no test.

Charles Newbold No. 1 Krug, SE SW SE sec. 4-15-14w. Drlg. 2,225 ft.

R. C. Tarrant No. 1 Williamson, SE SE NW sec. 9-14-14w.
Tarkio lime 2,515 ft.; T.D. 2,550 ft.; swbd. 5 bbls. oil per hr., and showing of wtr.; acidized with 1,000 gals.; made potential of 243 bbls. of oil.

P. G. Reynolds No. 1 Fredrickson, SE SW SE sec. 6-13-12w. Drlg. 2,075 ft.

Sedgwick County

Dickey Oil Co. No. 1 Ayers, SW SW NW sec. 12-27-2. Moving in material.

T. C. Johnson No. 1 Jansen, SW SW NW sec. 11-28-2. Shut down, 2,340 ft.

Stafford County

L. A. Farris et al No. 1 Snyder, SE SE NW sec. 3-21-11w. Gas estimated 1,000,000 ft., 2,938 to 2,940 ft.; running 8-inch pipe.

Kessler & Their No. 1 Evans, NE NE NE sec. 20-21-11w.
Rigging up rotary.

Larlo O. & G. Co. et al No. 1 Andress. C NW NE sec. 1-21-13w. Moving in material.

Sumner County

Craft & Wilson No. 1 Nevitt, NE NW NE, sec. 36-32-2e. Fishing, 457 ft.

Helmerich & Payne et al No. 1 Elwell, NW NW NE sec. 18-34-1. Drlg. 1,240 ft.

Matthews & Derrington No. 1 Berry, NW NW SE sec. 14-35-1. Spudded and shut down.

Morgan et al No. 1 Veail, SE SW NE sec 27-32-2. Drlg. 3,061 ft.

Wilcox O. & G. Co. et al No. 1 Hess, SE SE NW sec. 13-34-2w. Building rig.

D. J. Wilson et al's No. 1 Ciark, 4,320 ft from W and 25 ft. from S line of NW sec. 15-35-1w. Drlg. 3,100 ft.

Trego County

A. W. Ault et al No. 1 Loflin, NE NE SW sec. 22-13-21w.
Cellar.

Central Commercial's No. 1 Wagg, NW NW SE sec. 17-13-21w. K.C. lime 3,548 ft.; bailed 30 bbls. oil per day; acidized; bailed 12 bbls. oil per day; drlg. 3,906 ft.

Continental Oil Co. No. 1 Holcomb, E½ E½ NW sec. 26-11-23w. Drlg. 2,370 ft.

Worsley No. 1 Puritan, SW cor. sec. 32-13-25w.
Cellar.

Woodson County

J. F. Mergen et al No. 1 Vermont Savings Bank, NE NW NE sec. 15-25-14.
Mississippi lime 1,564 ft.; C.O. 1,610 ft.

C. L. Sheedy No. 1 Baker, SE SE NW sec. 2-26-14. Drlg. 400 ft.

Max Reynolds No. 1 Guy, NE NE SE sec. 29-25-14. Drlg. 450 ft.

C. L. Sheedy et al No. 1 Grand Lodge. C E½ NW SW sec. 4-25-14. Drlg. 630 ft.

IMPORTANT WELLS AND NORTHERN CALIFORNIA WILDCATS

Company, well and location—	S.T.R.	Depth	Status
Shell Oil Co., No. 11 Capitan, Santa Barbara Co.	32- 4-30	1,191	sd. sh. drlg.
Shell Oil Co., No. 12 Capitan, Santa Barbara Co.	32- 4-30	....	rigging up
Honolulu Oil Corp., No. 9 Elwood, Santa Barbara Co.	tideland	4,397	rd. sd. drlg.
Barnsdall Oil Co., No. 1 Elwood, Santa Barbara Co.	15- 4-29	3,208	cleaning out
Barnsdall-Rio Grande, No. 12 Elwood, Santa Barbara	15- 4-29	7,700	sd. sh. drlg.
Barnsdall-Rio Grande, No. 14 Elwood, Santa Barbara	15- 4-29	3,534	C.P. 3,431
Bankline Oil Co., No. 4 Elwood, Santa Barbara Co.	tideland	3,496	sd. sh. drlg.
Signal Oil Co., No. 7 Elwood, Santa Barbara Co.	tideland	2,270	hd. sh. drlg.
Spalding, Caroline, No. 6 Elwood, Santa Barbara Co.	tideland	3,505	pump. 50 b.d.
York Oil Co., No. 1 Lompoc, Santa Barbara Co.	33- 8-24	....	bldg. rig
Union Oil Co., No. 1 Santa Maria, Santa Barbara Co.	24-10-34	1,654	sd. sh. drlg.
Santa Barbara Oil, No. 1 Carpinteria, Santa Barbara	29- 4-25	2,290	P.B. 2,200
Union Oil Co., No. 1 Sudden, Santa Barbara Co.	10- 5-25	....	rigging up
Anacopa Oil Co., No. 4 Mesa, Santa Barbara Co.	28- 4-27	....	bldg. rig
Calco Pet. Co., No. 1 Las Posas, Ventura Co.	17- 2-20	2,586	cmtd. 2,585
Duke Oil Co., No. 1 Bardsdale, Ventura Co.	7- 3-19	1,998	cleaning out
Bankline Oil Co., No. 1 Sespe, Ventura Co.	36- 5-20	2,610	hd. sh. drlg.
Nelson & Co., No. 1 Sespe, Ventura Co.	28- 4-19	1,632	rd. sd. drlg.
El Rancho Oil Co., No. 1 Shiells Canyon, Ventura Co.	2- 3-19	3,493	sd. sh. drlg.
Beetco Pet. Co., No. 1 Shiells Canyon, Ventura Co.	2- 3-19	361	sd. sh. drlg.
Bankline Oil Co., No. 1 Shiells Canyon, Ventura Co.	3- 3-19	3,534	will deepen
Petroleum Securities, No. 1 Shiells Canyon, Ventura Co.	3- 3-19	....	bldg. rig
The Texas Co., No. 129 Shiells Canyon, Ventura Co.	4- 3-19	3,042	cleaning out
Hull, James, No. 1 Santa Susana, Ventura Co.	2- 2-18	1,500	cleaning out
Boise Chica Oil Co., No. 3 Temescal, Ventura Co.	4- 4-18	440	cmtd. 430
Dawson Oil Co., No. 1 Simi, Ventura Co.	5- 2-17	2,376	sd. sh. drlg.
Stella, E. F., No. 1 Simi, Ventura Co.	6- 2-17	1,931	sd. sh. drlg.
Ventura Expl. Co., No. 1 Saticoy, Ventura Co.	36- 3-22	7,072	P.B. 6,435
General Pet. Corp., No. 2 Oxnard, Ventura Co.	26- 2-23	1,982	sd. sh. drlg.
General Pet. Corp., No. 4 Rincon, Ventura Co.	tideland	2,241	sd. sh. drlg.
Continental Oil Co., No. 2 Ojai, Ventura Co.	13- 4-22	962	pump. 10 b.d.
Continental Oil Co., No. 6 San Miguelito, Ventura Co.	24- 2-24	....	bldg. rig
Standard Oil Co., No. 1 Lost Hills, Kern Co.	2-26-20	6,261	sd. sh. drlg.
Belmac Drlg. Co., No. 1 McKittrick, Kern Co.	22-29-21	4,797	fish. D.P.
Franco-Western Oil Co., No. 12 McKittrick, Kern Co.	8-30-22	....	bldg. rig
Bergman, H. L., No. 2 McKittrick, Kern Co.	30-30-22	520	sd. sh. drlg.
Bergman Oil Co., No. 1 McKittrick, Kern Co.	32-29-22	....	rigged up
Standard Oil Co., No. 4 North Belridge, Kern Co.	34-27-20	4,150	sd. sh. drlg.
Belridge Oil Co., No. 15-35 North Belridge, Kern Co.	35-27-20	5,383	cmtd. 5,351
Belridge Oil Co., No. 6-1 North Belridge, Kern Co.	1-28-21	7,176	hd. sh. drlg.
Belridge Oil Co., No. 17-35 North Belridge, Kern Co.	35-27-20	4,160	sd. sh. drlg.
Union Oil Co., No. 20 North Belridge, Kern Co.	36-27-20	9,492	P.B. 9,153
Union Oil Co., No. 21 North Belridge, Kern Co.	36-27-20	1,597	sd. sh. drlg.
Continental Oil Co., No. 7 North Belridge, Kern Co.	36-27-20	4,896	sd. sh. drlg.
Standard Oil Co., No. 7 Delano, Tulare Co.	34-24-23	3,308	cmtd. 2,415
Alford, J. W., No. 1 Delano, Kern Co.	14-25-27	2,440	resume work
C. C. M. Oil Co., No. 14 Kern Front, Kern Co.	23-28-27	2,150	C.P. 1,890
Republic Pet. Co., No. 7 Kern Front, Kern Co.	24-28-27	2,007	pump. 400 b.d.
Republic Pet. Co., No. 8 Kern Front, Kern Co.	24-28-27	971	sd. sh. drlg.
Hjorth & Gordon, No. 1 Kern River, Kern Co.	36-28-27	2,461	gr. sd. drlg.
General Pet. Corp., No. 5 Kern Front, Kern Co.	14-28-27	....	rigged up
Webber, T. A., No. 1 Kern Front, Kern Co.	16-28-27	....	rigging up
Standard Oil Co., No. 10 Kern Front, Kern Co.	5-28-27	2,835	P.B. 2,750
Standard Oil Co., No. 11 Kern Front, Kern Co.	5-28-27	1,490	sd. sh. drlg.
Standard Oil Co., No. 12 Kern Front, Kern Co.	24-28-27	....	bldg. rig
The Texas Co., No. 14 Kern Front, Kern Co.	23-28-27	....	rigging up
Vega Oil Co., No. 1 Kern Front, Kern Co.	11-28-27	1,725	pump. 148 b.d.
Ausbrit Oil Co., No. 1 Premier, Kern Co.	20-27-27	2,125	resume work
Recovery Oil Co., No. 1 Dominion, Kern Co.	28-26-28	....	rig; susp.
Falcon Oil Co., No. 1 Dominion, Kern Co.	27-26-28	810	cleaning out
Brown, S. C., No. 1 Mount Poso, Kern Co.	22-27-27	....	grade
General Petroleum, No. 16 Mount Poso, Kern Co.	16-27-28	1,742	pump. 240 b.d.
General Petroleum, No. 17 Mount Poso, Kern Co.	16-27-28	1,542	sd. sh. drlg.
Baker, Cliff, No. 4 Mount Poso, Kern Co.	33-27-28	....	bldg. rig
Cal. Coast-Apex Oil Co., No. 1 Mount Poso, Kern Co.	36-26-27	....	rigging up
The Texas Co., No. 10 Mount Poso, Kern Co.	4-27-28	1,759	bailing
Woods & Bailey, No. 1 McFarland, Kern Co.	16-26-26	3,295	sd. sh. drlg.
Dixie Lee Oil Co., No. 1 Fruitvale, Kern Co.	23-29-27	3,772	swabbing
The Texas Co., No. 1 Fruitvale, Kern Co.	26-29-27	4,685	sd. sh. drlg.
Magnet Oil Co., No. 1 Fruitvale, Kern Co.	21-29-27	1,065	sd. sh. drlg.
Mohawk Oil Co., No. 10 Fruitvale, Kern Co.	23-29-27	....	rigging up
North American, No. 1 Mountain View, Kern Co.	5-31-29	6,000	sd. sh. drlg.
Hogan Pet. Co., No. 9 Mountain View, Kern Co.	5-31-29	6,260	flow. 1,500 b.d.
Hogan Pet. Co., No. 10 Mountain View, Kern Co.	29-30-29	5,795	sd. sh. drlg.
Hogan Pet. Co., No. 11 Mountain View, Kern Co.	32-30-29	3,760	sd. sh. drlg.
Buffalo Oil Co., No. 1 Mountain View, Kern Co.	19-30-29	5,117	flow. 690 b.d.
Sheldon Oil Corp., No. 1 Mountain View, Kern Co.	19-30-29	4,966	cleaning out
Wood-Callahan Oil Co., No. 2 Mountain View, Kern Co.	25-30-28	5,673	test. W.S.O.
Mohawk Oil Co., No. 16 Mountain View, Kern Co.	30-30-29	6,035	bailing
Mohawk Oil Co., No. 18 Mountain View, Kern Co.	30-30-29	2,965	sd. sh. drlg.
Ohio Oil Co., No. 3 Mountain View, Kern Co.	33-30-29	5,159	cmt. whipst'k
Allied Pet. Corp., No. 1 Mountain View, Kern Co.	19-30-29	3,951	sd. sh. drlg.
Treasure Oil Co., No. 1 Mountain View, Kern Co.	12-30-28	....	rigging up
Shell Oil Co., No. 7 Mountain View, Kern Co.	32-30-29	6,050	O.S. drlg.
Shell Oil Co., No. 8 Mountain View, Kern Co.	32-30-29	5,200	cmtd. 4,976
Shell Oil Co., No. 9 Mountain View, Kern Co.	32-30-29	1,002	sd. sh. drlg.
Shell Oil Co., No. 10 Mountain View, Kern Co.	32-30-29	....	rigging up
Shell Oil Co., No. 11 Mountain View, Kern Co.	32-30-29	....	rigging up
Standard Oil Co., No. 23 Mountain View, Kern Co.	13-30-28	5,551	sd. sh. drlg.
Standard Oil Co., No. 24 Mountain View, Kern Co.	13-30-28	5,285	completing
Standard Oil Co., No. 25 Mountain View, Kern Co.	13-30-28	5,240	sd. sh. drlg.
Mountain View Oil Co., No. 1 Mountain View, Kern Co.	25-30-28	5,814	cleaning out
Jergins Trust, No. 5 Mountain View, Kern Co.	24-30-28	5,848	cleaning out
Ohio Oil Co., No. 1 Rio Bravo, Kern Co.	1-30-25	2,640	form. test
Shell Oil Co., No. 1 Stevens, Kern Co.	29-30-26	6,250	sd. sh. drlg.
Shell Oil Co., No. 11 Round Mountain, Kern Co.	7-28-29	1,480	sd. sh. drlg.
Helm & Pruitt, No. 1 Round Mountain, Kern Co.	17-28-29	....	bldg. rig
California Western Oil, No. 8 Round Mountain, Kern	7-28-29	1,573	sd. sh. drlg.
California Western Oil, No. 9 Round Mountain, Kern	7-28-29	....	rigging up
Barnsdall Oil Co., No. 3 Round Mountain, Kern Co.	7-28-29	1,684	sd. sh. drlg.
Honolulu Oil Corp., No. 12 Round Mountain, Kern Co.	18-28-29	2,100	completing
Honolulu Oil Corp., No. 13 Round Mountain, Kern Co.	18-28-29	....	rigging up
Berry Oil Co., No. 2 Edison, Kern Co.	10-30-29	1,942	pump. 120 b.d.
Bauer Oil Co., No. 1 Edison, Kern Co.	21-30-29	3,157	cmtd. 2,900
Jergins Trust, No. 22 Edison, Kern Co.	22-30-29	1,971	sd. sh. drlg.
Jergins Trust, No. 23 Edison, Kern Co.	23-30-29	....	rigging up
Buckeye Union Oil Co., No. 1 Edison, Kern Co.	22-30-29	1,320	sd. sh. drlg.
Corbett, J., No. 1 Edison, Kern Co.	23-30-29	....	rigging up
Whittier-Santa Fe Oil Co., No. 1 Edison, Kern Co.	21-30-29	1,584	sd. sh. drlg.
Monterey Expl. Co., No. 5 Edison, Kern Co.	14-30-29	2,699	redrlg. 1,825
The Texas Co., No. 1 Edison, Kern Co.	23-30-29	....	rigged up
General Pet., No. 13 Edison, Kern Co.	24-30-29	1,576	pump. 45 b.d.
General Pet., No. 14 Edison, Kern Co.	24-30-29	....	rigging up
Union Oil Co., No. 4 Edison, Kern Co.	14-30-29	2,412	dry; abd.
General Pet. Corp., No. 1 Elk Hills, Kern Co.	5-30-24	5,895	cleaning out
Gibson Oil Co., No. 2 Maricopa, Kern Co.	6-11-23	2,850	flow. 1,100 b.d.
Chief Oil Co., No. 1 Maricopa, Kern Co.	6-11-23	4,468	cleaning out
Standard Oil Co., No. 24 Midway-Sunset, Kern Co.	36-12-24	1,870	rig to deepen
Standard Oil Co., No. 25 Midway-Sunset, Kern Co.	36-12-24	2,000	rig to deepen
Standard Oil Co., No. 218 Midway-Sunset, Kern Co.	33-32-24	3,032	rig to pump
General Pet. Corp., No. 1 Maricopa, Kern Co.	6-11-23	....	bldg. rig
Alford Oil Co., No. 4 Maricopa, Kern Co.	25-12-24	....	rigging up
Hallmark Oil Co., No. 4 Maricopa, Kern Co.	25-12-24	2,841	sd. sh. drlg.
Cal-Con'l Oil Co., No. 9 Midway-Sunset, Kern Co.	26-32-23	1,581	br. sh. drlg.
Pet. Drlg. & Expl. Co., No. 2 Maricopa, Kern Co.	25-12-24	2,396	sd. sh. drlg.
Jerman, R. W., No. 1 Midway-Sunset, Kern Co.	31-12-23	....	rigging up
Evans, H. E., No. 12 Midway, Kern Co.	35-32-23	1,798	O.S. drlg.
Superior Oil Co., No. 1 Buena Vista, Kern Co.	6-32-25	....	bldg. rig
Silver Gate Oil & Gas Co., No. 1 Tejon, Kern Co.	7-10-19	3,005	redrlg. 2,782
Reserve Oil Co., No. 1 Tejon, Kern Co.	33-11-19	6,032	resume work
Seaboard Oil Co., No. 3 Huron, Fresno Co.	30-16-14	3,094	sd. sh. drlg.
Conlon, J. M., No. 1 Coalinga, Fresno Co.	30-19-15	471	sd. sh. drlg.
Union Oil Co., No. 1 Lillis-Welsh, Fresno Co.	24-21-16	11,127	cleaning out
K. N. D. A., No. 2 Kettleman North, Fresno Co.	20-21-17	3,160	sd. sh. drlg.
K. N. D. A., No. 54 Kettleman North, Fresno Co.	24-21-16	8,828	testing
K. N. D. A., No. 74 Kettleman North, Fresno Co.	30-21-17	....	rigged up
Standard Oil Co., No. 43 Kettleman North, Fresno Co.	19-21-17	....	bldg. rig
Standard Oil Co., No. 65 Kettleman North, Fresno Co.	19-21-17	....	bldg. rig
Standard Oil Co., No. 2 Kettleman Middle, Kings Co.	29-23-19	8,100	hd. sd. drlg.
Petroleum Securities, No. 2 Kettleman Middle, Kings	30-23-19	9,332	P.B. 4,670
Royalty Service Corp., No. 1 Pyramid Hills, Kings Co.	16-24-18	3,397	sd. sh. drlg.
Emerich Oil Co., No. 1 Cholame, San Luis Obispo Co.	22-32-22	1,871	hd. sd. drlg.
Kettleman View Oil Co., Well No. 1, Kings Co.	29-22-19	1,600	hd. sd. drlg.
Commonwealth Consd. Gas, No. 2 Tulare Lake, Kings	21-22-20	2,495	sd. sh. drlg.
Union-Hancock, No. 1 Tulare Lake, Kings Co.	28-22-20	3,462	sd. sh. drlg.
Amerada Pet., No. 2 Tracy, San Joaquin Co.	15- 2-5	4,063	producing gas
Amerada Pet., No. 3 Tracy, San Joaquin Co.	22- 2-5	4,060	producing gas
Amerada Pet., No. 7 Tracy, San Joaquin Co.	15- 2-5	4,149	cmtd. 3,898
Standard Oil Co., No. 1 McDonald Island, San Joaquin	25- 2-4	....	bldg. rig
Northern Counties Pet., No. 1 Tehama, Tehama Co.	25-24-3	7,030	sd. sh. drlg.
Shell Oil Co., No. 1 Branch, Monterey Co.	34-24-10	7,332	prod. test
The Texas Co., No. 3 Eureka, Humboldt Co.	22- 3-1	1,151	sd. sh. drlg.

IMPORTANT WELLS AND SOUTHERN CALIFORNIA WILDCATS

Company, well and location—	S.T.R.	Depth	Status
Republic Pet. Co., No. 2 El Segundo, Los Angeles Co.	18- 3-14	6,592	sd. sh. drlg.
Marvin, J. L., No. 1 El Segundo, Los Angeles Co.	7- 3-14	6,410	form. test
Sovereign Oil Co., No. 1 El Segundo, Los Angeles Co.	22- 3-14	8,766	cleaning out
Cone Oil Co., No. 1 Lawndale, Los Angeles Co.	20- 3-14	5,231	sd. sh. drlg.
Shell Oil Co., No. 1 Moneta, Los Angeles Co.	32- 3-14	4,975	sd. sh. drlg.
Big Ben Oil Co., No. 1 Hermosa, Los Angeles Co.	31- 3-14	....	bldg. rig
White Five Oil Co., No. 1 Hermosa, Los Angeles Co.	31- 3-14	3,594	sd. sh. drlg.
Sterling Oil Co., No. 1 Hermosa, Los Angeles Co.	31- 3-14	4,200	redrlg. 3,902
Dumas-Lewis Oil Co., No. 1 Redondo, Los Angeles Co.	6- 4-14	3,736	pump. 235 b.d.
B. & N. Oil Co., No. 1 Redondo, Los Angeles Co.	18- 4-14	971	sd. sh. drlg.
Rennek Oil & Gas Co., No. 1 Redondo, Los Angeles Co.	8- 4-12	....	rigging up
C. C. M. Oil Co., No. 23 Torrance, Los Angeles Co.	8- 4-14	4,431	sd. sh. drlg.
West American Oil Co., No. 1 Dominguez, Los Angeles	3- 4-13	6,890	sd. sh. drlg.
Shell Oil Co., No. 1 Long Beach, Los Angeles Co.	13- 4-13	6,035	fish. D. P.
Barnsdall Oil Co., No. 15 Rosecrans, Los Angeles Co.	18- 3-13	3,896	redrlg. 4,510
Mars Oil Co., No. 1 Athens, Los Angeles Co.	7- 3-13	4,850	redrlg. 1,530
Continental Oil Co., No. 35 Seal Beach, Los Angeles	3- 5-12	4,940	sd. sh. drlg.
Engler & Long, No. 1 Artesia, Los Angeles Co.	25- 3-12	5,888	P.B. 5,113
Davis & Lewis, No. 1 Artesia, Los Angeles Co.	25- 3-12	....	bldg. rig
Clayton, C. L., No. 1 Long Beach, Los Angeles Co.	31- 2-12	6,765	cleaning out
Standard Oil Co., No. 16 Inglewood Deep, Los Angeles	8- 2-14	3,150	P.B. 3,033
Ohio Oil Co., No. 18 Del Rey, Los Angeles Co.	22- 2-15	5,900	sd. sh. drlg.
Eastern Oil Co., No. 1 Del Rey, Los Angeles Co.	22- 2-15	6,050	sd. sh. drlg.
Royalty Service Corp., No. 6 Del Rey, Los Angeles Co.	22- 2-15	1,671	sd. sh. drlg.
Anglo American Oil Co., No. 1 Del Rey, Los Angeles	27- 2-15	6,939	C.P. 6,750
Herndon Dev. Co., No. 1 Del Rey, Los Angeles Co.	27- 2-15	6,623	cmtd. 6,497

Union Oil Co., No. 20 Del Rey, Los Angeles Co.	27-	2-15	6,188	completing
Union Oil Co., No. 21 Del Rey, Los Angeles Co.	27-	2-15	....	bldg. rig
Yant Pet. Corp., No. 1 Newhall, Los Angeles Co.	1-	3-16	1,762	hd. sh. drlg.
Yant Pet. Corp., No. 2 Newhall, Los Angeles Co.	36-	4-16	....	rigging up
Eyer Pet. Co., No. 1 Compton, Los Angeles Co.	20-	4-13	2,794	cleaning out
Sovereign Oil Co., No. 1 Wilmington, Los Angeles Co.	28-	4-13	....	bldg. rig
Monarch Oil Corp., No. 1 Topanga, Los Angeles Co.	5-	1-16	652	cmtd. 625
Standard Oil Co., No. 79 Montebello, Los Angeles Co.	2-	2-12	5,171	sd. sh. drlg.
Standard Oil Co., No. 80 Montebello, Los Angeles Co.	2-	2-12	3,850	P.B. 3,767
Standard Oil Co., No. 81 Montebello, Los Angeles Co.	2-	2-12	2,630	cleaning out
Standard Oil Co., No. 82 Montebello, Los Angeles Co.	2-	2-12	6,498	sd. sh. drlg.
Standard Oil Co., No. 83 Montebello, Los Angeles Co.	2-	2-12	....	rigging up
Standard Oil Co., No. 84 Montebello, Los Angeles Co.	2-	2-12	....	rigged up
Butler, C. R., No. 1 Montebello, Los Angeles Co.	14-	2-10	3,754	sd. sh. drlg.
Womac, Inc., No. 3 Montebello, Los Angeles Co.	4-	2-11	301	sd. sh. drlg.
Woodward, J. A., No. 1 Montebello, Los Angeles Co.	4-	2-11	3,112	will deepen
The Texas Co., No. 13 Montebello, Los Angeles Co.	5-	2-11	7,221	form. test
Universal Consd., No. 4 Montebello, Los Angeles Co.	5-	2-11	7,064	sd. sh. drlg.
Universal Consd., No. 6 Montebello, Los Angeles Co.	5-	2-11	....	bldg. rig
Wilshire Oil Co., No. 1 Montebello, Los Angeles Co.	5-	2-11	6,352	redrlg. 5,200
Richfield Oil Co., No. 1 Montebello, Los Angeles Co.	5-	2-11	2,471	sd. sh. drlg.
North American, No. 2 Montebello, Los Angeles Co.	5-	2-11	2,594	sd. sh. drlg.
Frontier Oil Co., No. 1 Pico, Los Angeles Co.	7-	2-11	5,246	P.H. 4,990
Oil & Gas Associates, No. 1 Pico, Los Angeles Co.	9-	2-11	3,516	hd. sd. drlg.
Great Coastal Oil Co., No. 1 Elsinore, Riverside Co.	36-	5-5	2,211	hd. sd. drlg.
Stevens, F. E., No. 1 Corona, Riverside Co.	27-	3-7	....	rigging up
Commander Oil Co., No. 1 Newport, Orange Co.	29-	6-10	863	recmtd. 821
Twentieth Century Oil Co., No. 1 Huntington, Orange	36-	5-11	5,170	P.B. 4,495
Hillman & Long, No. 1 Westminster, Orange Co.	14-	5-11	1,693	sd. sh. drlg.
Standard Oil Co., No. 1 Anaheim, Orange Co.	36-	3-9	2,656	rig to pump
Union Oil Co., No. 29 Chapman Richfield, Orange Co.	30-	2-9	1,031	sd. sh. drlg.
Continental Oil Co., No. 1 Yorba, Orange Co.	21-	3-9	3,380	sd. sh. drlg.

GULF COAST WILDCATS

Week Ending March 14

Raccoon Bend—Austin County

Humble O. & R. Co. No. 6-X Austin College, Wm. Harvey Sur. T.D. 3,305 ft.; perforated 3,288-3,302 ft.; swabbing.

Humble O. & R. Co. No. 17 Paine, Wm. C. White Sur. Drlg. 2,131 ft.

Humble O. & R. Co. No. 20 Thompson, Wm. C. White Sur. I.P. 12 bbls. per hour, ¼-in. choke, T.P. 305 lbs.; C.P. 520 lbs.

Byron Mound—Brazoria County

Texas Co. No. 3 Freeport Sulphur Co., C. Areola Sur. R.U.

Hastings—Brazoria County

Humble O. & R. Co. No. 4 Cannon, H.T.& B. Sur. No. 36. T.D. 1,825 ft.; 10¾-in. csg. at 1,818 ft.; W.O.C.

Stanolind O. & G. Co. No. 1 C. D. Brown, H.T.&B. Survey No. 29. Drlg. sand and lime 4,401 ft.

Stanolind O. & G. Co. No. 1 Droege Meyer, H.T.&B. Sur. No. 36. T. D. 1,886 ft.; 10¾-in. csg. 1,884 ft.; W.O.C.

Stanolind O. & G. Co. No. 4 Grote, A.C H.T.&B. Sur. No. 2. Drlg. shale and shells at 3,227 ft.

Stanolind O. & G. Co. No. 5 Shaw, H.T.& B. Sur. No. 36. T.D. 1,843 ft.; 10¾-in. csg. at 1,821 ft.; W.O.C.

Manvel—Brazoria County

Bowles & Barsodi No. 5 Norvell, Lot 45. sec. 23, H.&T.C. Sur. Rig up.

Burton Drlg. Co. No. 1 Gubbert, center of Lot No. 7 H.T.&B. Survey No. 33. T.D. 4,115 ft.; I.P. 1,000,000 ft. dry gas per day.

Texas Co. No. 5-B Belcher, H. N. Little Sur. Drlg. shale and lime at 3,350 ft.

Texas Co. No. 21 Houston Oil Field Assn., A.C.H.&B. Sur. No. 91. R.U.

Texas Co. No. 2 Natall, H. N. Little Sur. Drlg. shale 3,390 ft.

Turman Oil Co. No. 3 F. Hart, H.T.&B. Sur. No. 24. Derrick.

Anahuac—Chambers County

Humble O. & R. Co. No. 10 Broussard, sec. 36. Drlg. shale at 6,181 ft.

Humble O. & R. Co. No. 9 Clark, H.&T C. Sur. T.D. 7,085 ft.; I.P. 27 bbls. per hr., ¼-in. choke, T.P. 1,150 lbs.; C.P. 1,150 lbs.

Humble C & R. Co. No. 3 Engels, H.&T. C. Sur. No. 50. T.D. 1,546 ft.; 10¾-in. csg. at 1,514 ft.; W.O.C.

Humble O. & R. Co. No. 1 C. A. Lord, H.&T.C. Sur. Derrick.

Humble O. & R. Co. No. 1 Johnson, H.& T.C. Sur.; T.D. 1,546 ft.; 10¾-in. csg. at 1,514 ft.; W.O.C.

Humble O. & R. Co. No. 15 Middleton, H.&T.C. Sur. T.D. 1,540 ft.; 10¾-in. csg. at 1,518 ft.

Humble O. & R. Co. No. 4 Tyrell, H.&T.C. Sur. T.D. 7,052 ft.; 7-in. csg. at 7,040 ft.; I.P. 30 bbls. per hr., ¼-in. choke; T.P. 1,200 lbs.

Humble O. & R. Co., No. 5 Tyrell, H.& T.C. Sur. Setting 10¾-in. csg. at 1,546 ft.

Humble O. & R. Co. No. 7 White, James McGahey Sur. T.D. 7,087 ft.; 7-in. csg. at 7,065 ft.; I.P. 28 bbls. per hr., ¼-in. choke, T.P. 1,125 lbs.; C.P. 1,050 lbs.

Humble O. & R. Co. No. 1 Wilcox, H.&T C. Sur. T.D. 7,085 ft.; 7-in. csg. at 7,053 ft.; I.P. 27.6 bbls. per hr., ¼-in. choke; T.P. 1,000 lbs., C.P. 1,000 lbs.

Sun Oil Co. No. 9 White, J. McGahey Sur. Drlg. shale 4,887 ft.

Sun Oil Co. No. 10 White, J. McGahey Sur. 10¾ in. csg. at 1,206 ft.

Sun Oil Co. No. 11 White, J. McGahey Sur. Derrick.

Barbers Hill—Chambers County

Sinclair Prairie No. 19 Wilburn, Henry Griffith Sur. T.D. 5,275 ft.; hard sandy shale, underreaming.

Sun Oil Co. No. 18 Wilburn, Wm. Hodges Sur. T.D. 5,400 ft. I.P. 512 bbls. fluid per day, 50 per cent S.W., ¼-in. choke, 650 lbs. pressure.

Stanolind Oil & Gas Co. No. 20 Wilburn Wm. Hodges Sur. T.D. 4,394 ft., flowing by heads, preparing to pump.

Stanolind O. & G. Co.'s No. 29 Chambers Wm. Bloodgood Sur. Derrick.

Superior Oil Co. No. 2-B Barber, T.D. 4,645 ft. in shale; reaming to set 9⅝-in. csg.

Texas Gulf Prod. Co. No. 7 Wilburn, Wm. Hodges Sur. T.D. 5,350 ft.; sand showing oil; 7-in. csg. at 5,263 ft.; P.B. to 5,030 ft.; drilled to 5,067 ft.; csg. collapsed at 4,900 ft.; milling.

Turtle Bay—Chambers County

Stanolind O. & G. Co.-State No. 1 Turtle Bay. T.D. 6,615 ft.; 11 minute D.S.T. from 6,590-6,615 ft.; recovered 1,560 ft. of oil, 60 ft. S.W. and made 75 bbls. pressure, ⅝-in. on top.

Lost Lake—Chambers County

Pure Oil Co. No. 20 Mayes, E. H. R. Wallace Sur. T.D. 2,843 ft.; P.B. to 2,768 ft.; perforated from 2,320-25 ft. and 2,345-55 ft.; would not flow, swabbing.

Big Creek—Fort Bend

Gulf Prod. Co. No. 67 Davis, M. Young Sur. T.D. 3,910 ft.; I.P. 80 bbls. per day.

Blue Ridge—Fort Bend County

Ben Barnett No. 1 Blakely, E. Drew Sur. T.D. 1,995 ft.; swabbed dry, S.D.

Gulf Prod. Co. No. 19-B Bassett Blakely, E. Drew Survey. Drlg. shale 4,742 ft.

S. S. Rainer No. 1 J. M. Davidson, S Poitevent Sur. No. 3. T.D. 3,414 ft. 7-in. csg. at 3,380 ft.; flowing S.W.

D. M. Wallace and Woodley Pet. Co. No. 2 Blakely, E. Drew Sur. Drlg. shale 3,320 ft.

Boling—Wharton County

Texas Co. No. 16-A Anne Taylor, S. F. Austin Sur. Drlg. shale and lime at 2,455 ft.

Orchard—Fort Bend County

Gulf Prod. Co. No. 44 Moore, Leo Burknapp Sur. Drlg. shale 5,688 ft.

Gulf Ref. Co. No. 45 Moore, German Immigration Sur. No. 8. Sand 6,705 ft.

Gulf Prod. Co. No. 3-A Moore, Leo Burknapp Sur. Drlg. lime at 1,772 ft.

High Island—Galveston County

Stanolind O. & G. Co. No. 5 B.&N.O., Fitzsimmons Sur. Drlg. shale 6,193 ft.

Stanolind O. & G. Co. No. 54 Cade, W Fitzsimmons Sur. Drlg. sand and shale 2,854 ft.

Stanolind O. & G. Co. No. 55 Cade, Wm. Hudson Sur. Drlg. sand 114 ft.

Stanolind Oil & Gas Co. No. 18-B Smith Royalty, M. Dunman Sur. Drlg. sand at 1,688 ft.

Dickinson—Galveston County

Coast Pet. Co. No. 3 Stewart, W. K. Wilson Sur. S.D. 6,807 ft.

Humble O. & R. Co. No. 2-B Bayou Dev. Co. Drlg. shale with sandy streak 7,697 ft.

Humble O. & R. Co. No. 5-A Stewart, John Sellers Sur. Rig.

Humble O. & R. Co. No. 5-B Stewart, J. Sellers Sur. Drlg. sand and boulders at 3,218 ft.

Humble O. & R. Co. No. 1 W. H. Wilson, Blk. 103, San Leon Farm Subd., A. E. Edwards Sur. Drlg. shale and sand at 7,850 ft.

Pure Oil Co. No. 3 Shelar, B.B.B.&C. Sur. T.D. 7,627 ft.; mixing mud.

Stanolind O. & G. Co. No. 3 State, Tract 3. T.D. 8,132 ft.; 7-in. csg. 8,080 ft.; P.B to 8,025 ft.; perforated 7,997-8,024 ft.; failed to flow; swabbing.

Stanolind O. & G. Co. No. 4 State, Tract 3. Derrick.

Stanolind O. & G. Co. No. 5 State, Tract 3. Drlg. shale 1,685 ft.

Batson—Hardin County

Deering et al No. 2 Jordan, W. Donoho Sur. Drlg. shale at 3,975 ft.

Nimrod Prod. Co. No. 1 Butler, W. Donoho Sur. Bldg. derrick.

Pierce Junction—Harris County

Harrison and Abercrombie No. 8 Ritter J. Hamilton Sur. Drlg. sandy lime 3,504 ft.

Rio Bravo Oil Co. No. 10 fee, B.B.B.&C. Sur. Drlg. sandy shale 4,291 ft.

Rio Bravo Oil Co. No. 4 G.H.&S.A., G.H.& S.A. R.R. track. Set 7-in. csg. 4,433 ft.

Humble—Harris County

Texas Co. No. 51 Stevenson, J. B. Stevenson Sur. R.U.

Mykawa—Harris County

West Prod. Co. No. 8 Irwin, W. B. Walker Sur. T.D. 4,573 ft.; 7-in. csg. 4,360 ft.; running screen; I.P. 29 bbls. per hr. through ¼-in. choke.

South Houston—Harris County

Smith & McDannald No. 1 S. S. Vallos, Mary Nichols Sur. Drlg. shale 1,930 ft.

Stanolind O. & G. Co. No. 2 First National Bank, Callahan and Vince Sur. Coring in sand 4,739 ft.

Stanolind O. & G. Co. No. 1 Griffin, H. T.&B. Sur. No. 36. T.D. 4,875 ft.; 7⅝-in. csg. at 4,830 ft.; failed to flow; R.U. to pump.

Stanolind O. & G. Co. District No. 4, H. T.&B. Sur. T.D. 1,523 ft.; running 10¾-in. csg.

Stanolind O. & G. Co. District No. 6, H. T.&B. Sur. T.D. 103 ft., 16-in. csg. 90 ft.; W.O.C.

Stanolind O. & G. Co. District No. 7, H. T.&B. Sur. T.D. 1,515 ft., running 10¾-in. csg.

Stanolind O. & G. Co. District No. 20, H. T.&B. Sur. T.D. 105 ft.; run. 16-in. csg.

Stanolind O. & G. Co. No. 1, District 46, center of Lot 8, Blk. 158, H.T.&B. Sur. No. 5. T.D. 4,301 ft.; reaming.

Tomball—Harris County

Humble O. & R. Co. No. 4 Fores, W. Usner Sur. R.U.

Humble O. & R. Co. No. 2 Frederick, J. M. Hooper Sur. Comp.; no gauge.

Humble O. & R. Co. No. 3 Hoffman, J. House Sur. T.D. 5,580 ft.; 7-in. csg. at 5,573 ft.; W.O.C.

Humble O. & R. Co. No. 3-A Kob, J. M. Hooper Sur. T.D. 5,566 ft.; 7-in. csg. at 5,560 ft.; I.P. 17 bbls. per hr., ¼-in. choke; T.P. 750 lbs., C.P. 1,150 lbs.

Humble O. & R. Co. No. 1 West, Elizabeth Smith Sur. Drlg. shale 1,735 ft.

Shell Pet. Corp. No. 1 Robertson. T.D. 5,562 ft.; making drill stem test.

Sun Oil Co. No. 6 Metzler, C. N. Pillot Sur. Drlg. shale at 4,201 ft.

Amelia—Jefferson County

Humble O. & R. Co. No. 1 Broussard C. Williams Sur. Drlg. shale 6,526 ft.

Humble O. & R. Co. No. 2 R. C. Miller, A. Savery Sur. Drlg. shale 5,992 ft.

Glenn McCarthy No. 1 Bessie Longe, H. Williams Sur. T.D. 6,818 ft. in shale; P.B. to 6,004 ft.; perforated csg. from 5,835-55 ft.; I.P. 75 bbls. of distillate per day, 1/32-in. choke, T.P. 1,975 lbs., C.P. 2,200 lbs.

Glenn McCarthy No. 2 Bessie Longe, H. Williams Sur. Derrick.

Fannett—Jefferson County

Blue Eagle Oil Co. No. 2 Junker, W. H. Smith Sur. Drlg. shale and lime 5,765 ft.

Gulf Oil Corp. No. 18 Thomas, W. H. Smith Sur. Drlg. shale 3,940 ft.

Cleveland—Liberty County

Gulf Oil Corp. No. 14-C Kirby, C. J. Pleasant Sur. R.U.

Esperson—Liberty County

General Crude Oil Co. No. 11 T. E. Davis, D. Kokernot Sur. Drlg. shale 4,430 ft.

General Crude Oil Co. No. 14 Davis, D. Kokernut Sur. Derrick.

General Crude Oil Co. No. 23 Esperson, Fisher Sur. Drlg. shale 2,430 ft.

Hankamer—Liberty County

Gulf Oil Corp. No. 6 Crow and Jacobs, H.&T.C. Sur. No. 21. R.U.

Hardin—Liberty County

Atlantic Oil & Prod. Co. et al No. 1 Hardy, James Robinson Sur. Derrick.

Hull—Liberty County

Humble O. & R. Co. No. 39 Guedry, J. Devore Sur. Drlg. shale 233 ft.

Bay City—Matagorda County

Skelly Oil Co. No. 1 E. C. Metzger, M. Cummings Sur. T.D. 7,504 ft.; 7⅝-in. csg. at 7,504 ft.; W.O.C.

Skelly Oil Co. No. 4-B Cobb, M. Cummings Sur. Drlg. shale 6,449 ft.

Skelly Oil Co. No. 5-B Cobb, M. Cummings Sur. T.D. 7,503 ft.; 7⅝-in. csg. at 7,503 ft.; W.O.C.

Markham—Matagorda County

Hamill & Hamill No. 4 Kountze, H. Parker Sur. Abd. 3,998 ft.

Conroe—Montgomery County

Sun Oil Co. No. 27 Foster. T.D. 5,120 ft.; set screen and preparing to test.

Orange—Orange County

T. J. Ward et al No. 1 E. W. Brown, S. M. Luce Sur. Drlg. shale 4,210 ft.

Port Neches—Orange County

Texas Co. No. 6-B Polk, J. Beaumont Sur. T.D. 6,952 ft.; 7-in. csg. at 5,856 ft.; comp., no gauge.

Livingston—Polk County

Humble O. & R. Co. No. 27 Granbury, A. Viesca Sur. Set 10¾-in. csg. at 573 ft.; S.D.

Ownby-Shell No. 2 Munson, A. Viesca Sur. Drlg. shale at 2,310 ft.

Greta—Refugio County

United Gas Co. No. 23 Lambert, Hardwick Sur. Rig up.

Hewitt and Daugherty No. 22 Lambert, Hardwick Sur. Rig up.

Refugio—Refugio County

Local Oil Co. No. 1 W. L. Rea, Refugio Townsite. Drlg. shale 2,729 ft.

United Gas Co. No. 17 Fox Hews Survey. Drlg. 2,210 feet.

Tomcoconor—Refugio County

Quintana Oil Co. No. 30-A O'Conner, Swisher Sur. T.D. 5,960 ft.; I.P. 1,337 bbls. per day thru ¼-in. choke.

Quintana Oil Co. No. 32-A O'Conner, Swisher Sur. T.D. 5,969 ft.; 7-in. csg. set 5,958 ft.; perf. csg.; testing.

Quintana Oil Co. No. 33-A O'Conner, Swisher Sur. Derrick.

Colette Creek—Victoria County

American Liberty Oil Co. No. 3 Machalle, R. Manchola Sur. Drlg. sandy shale 2,670 ft.

National Pet. Corp. No. 1 J. Stehle, Piedras Geliardo Sur. T.D. 5,390 ft.; D.S. stuck.

Placedo—Victoria County

American Liberty Oil Co. No. 4 Gray, S.A.&M.G. Survey, M.I.M.

Barnsdall Oil Co. No. 2 W. R. Smith, Lot 7. T.D. 6,035 ft.; D.S.T. from 6,027-35 ft.

Barnsdall Oil Co. et al No. 1 J. S. Wheless, J. M. Bronson Sur. No. 8. I.P. 25 bbls. per hour through ¼-in. choke; T.P. 450 lbs., C.P. 500 lbs.

Barnsdall Oil Co. No. 2 Pickering-Rees, S.A.&M.G. R.U.

Barnsdall Oil Co. No. 3 J. M. Pickering S.A.&M.G. Sur. No. 5. R.U.

Eastern Texas Prod. Co. No. 1 Krappa, Lot 12, Wm. Rupley Sur. T.D. 6,480 ft.; 5 3/16-in. csg. at 5,370 ft.; perforated; 5,340-45 ft.; flowed salt water.

Harrison & Abrocrombie No. 1 C. O. Voss, J. M. Bronson Sur. Cemented 10¾-in. csg. at 824 ft.

Superior O. & G. Co. et al No. 2 Janis, Wm. Rupley Sur., A-290. T.D. 4,743 ft.; 5 3/16-in. csg. set on bottom; perforated; tested gas, shut in.

Sun Oil Co. No. 3 J. J. Marek, J. M. Brownson Sur. T.D. 4,778 ft., 7-in. csg. at 4,755 ft.

Clay Creek—Washington County

Sun Oil Co. No. 3 A. Draper, J. F. Perry Sur. Coring at 2,261 ft.

Sun Oil Co. No. 1 H. Lauter, N. Clay Sur. Moving in.

Louise—Wharton County

Pure Oil Co. No. 1 Rivers, sec. 19. Drlg. shale 460 ft.

Pure Oil Co. No. 3 Weaver, sec. 22, Morris & Cummings Sur. T.D. 5,157 ft.; 7-in. csg. at 5,124 ft.; I.P. 225 bbls. in 21 hours, ¼-in. choke.

Pickett Ridge—Wharton County

Texas Co. No. 12-A Pierce, I.&G.N. Sur. No. 38. T.D. 4,706 ft.; 7-in. csg. at 4,700 ft.; testing.

Texas Co. No. 13-A Pierce, I.&G.N. Sur. T.D. 1,323 ft.; 10-in. csg. at 1,301 ft.; drlg. plug.

Texas Co. No. 15-A Pierce, G.H.&S.A. R.R. right of way. R.U.

Withers—Wharton County

Texas Co. No. 1-B Pierce, E.T. R.R. Sur., Abst. No. 108. R.U.

Texas Co. No. 3-C Pierce, J. Caldwell Sur. Drlg. shale and lime 3,480 ft.

Texas Co. No. 4-C Pierce, J. Caldwell Sur. Building road.

SOUTH LOUISIANA FIELDS

Bay St. Elaine—Terrebonne Parish

Texas Co. No. 11 Bay St. Elaine, sec. 17-22s-18e. S.D. 6,731 ft.

Bayou Mallet—Acadia Parish

Superior Oil & Prod. Co. No. 1 Bradley, sec. 47-7s-1e. Drlg. sandy shale 6,851 ft.

Black Bayou—Cameron Parish

Shell Pet. Corp. No. 26 Watkins, sec. 18-12s-12w. S.D. 2,073 ft.

Shell Pet. Corp. No. 28 Watkins. P.B. to 4,306 ft.; swbng.

Shell Pet. Corp. No. 31 Watkins, sec. 8-12s-12w. T.D. 5,236 ft.; coring ahead.

Caillou Island—Terrebonne Parish

Texas Co. No. 22 Caillou Island, sec. 20-23s-20e. Drlg. sand 976 ft.

Texas Co. No. 2 Terrebonne Bay, sec. 19-23s-20e. Drlg. sandy shale 6,029 ft.

Texas Co. No. 32 State, sec. 17-23s-20e. T.D. 4,206 ft.; I.P. 1,027 bbls. per day, ⅝-in. choke; T.P. 590 lbs.

Texas Co. No. 35 State, sec. 17-23s-20e. Drlg. sand and lime 2,726 ft.

Cameron Meadows—Cameron Parish

Burton Sutton Oil Co. No. 12 School Land, sec. 16-14s-13w. Recovered 2,700 ft. of oil on drill stem from 3,780-3,800 ft.; set csg. and swabbed dry.

Burton Sutton Oil Co. No. 13 School Land, sec. 16-14s-13w. Derrick.

Texas Co. No. 3 Miami Corp., sec. 15-14s-13w. 12-in. csg. at 473 ft.; drlg. plugs.

Chaneyville—Rapides Parish

Amerada Pet. Corp. No. 1 Beasley, sec. 52-1s-2e. Drlg. shale 5,664 ft.

Texas Co. No. 1 Weil, sec. 53-1s-2e. R.U.

Texas Co. No. 2 Weil, sec. 53-1s-2e. R.U.

Texas Co. No. 1 State (Andrade), sec. 5-15s-2e. Moving in derrick.

Choctaw Dome—Iberville Parish

Standard Oil Co. No. 8 Myrtle Grove Wilburt, sec. 52-9s-11e. T.D. 5,328 ft.; P.B. to 3,000 ft.; sidetracked; drlg. 3,363 ft.

Darrow—Ascension Parish

Humble O. & R. Co. No. 10 Community, sec. 32-10s-2e. Coring sand 5,571 ft.

Humble O. & R. Co. No. 4 Gumble, sec. 33-10s-3e. Drlg. sand 5,934 ft.

Dog Lake—Terrebonne Parish

Texas Co. No. 3 State, sec. 5-22s-16e. Drlg. shale 4,347 ft.

Edgerly—Calcasieu Parish

J. G. Sutton No. 17 Lillard, sec. 28-9s-11w. S.D. 1,552 ft.
Thompson & Mossart No. 1 Fairchild. Drlg.

Garden Island Bay—Plaquemines Parish

Texas Co. No. 18 State, sec. 37-22s-29e. Drlg. shale 1,239 ft.

Gillis—Calcasieu Parish

Fohs Oil Co. No. 10 Castle, sec. 14-9s-8w T.D. 7,085 ft.; 7-in. csg. set on bottom. I.P. 585 bbls. per day 1¼-in. choke.
Fohs Oil Co. No. 1 Frost, sec. 11-9s-8w. T.D. 5,249 ft.; 7-in. csg. 5,257 ft.; tested 500,000 ft. gas, deepened to 5,272 ft.; tested S.W.
Fohs Oil Co. No. 1 Mary McIver, sec. 14-9s-8w. Derrick.
Texas Co. No. 8 Nickerson, sec. 13-9s-8w T.D. 6,717 ft.; 6⅝-in. csg. at 6,708 ft.; W.O.C.
Union Sulphur Co. No. 1 J. A. Bel estate. Drlg. shale 1,776 ft.
Union Sulphur Co. No. 1 G. S. Cole, sec. 12-9s-8w. Spudded.
Union Sulphur Co. No. 6 Castle, sec. 13-9s-8w. Drlg. shale 7,170 ft.
Union Sulphur Co. No. 5 Powell Lumber Co., sec. 12-9s-8w. T.D. 6,677 ft.; I.P. 600 bbls. per day, ¼-in. choke.
Union Sulphur Co. No. 18 State, sec. 13-9s-8w. Drlg. shale 6,581 ft.

Hackberry—Cameron Parish

Gulf Ref. Co. No. 20 Irwin, sec. 13-13s-10w. Drlg. shale 7,606 ft.
Stanolind O. & G. Co. No. 16-A School Land, sec. 16-12s-12w. R.U.
Stanolind O. & G. Co. No. 21-B Gulf Land, sec. 14-12s-10w. Drlg. shale 6,306 ft.
Texas Co. No. 19-B State, sec. 13-12s-9w. Drlg. shale 4,733 ft.

Iowa—Jefferson Davis Parish

Shell Pet. Corp. No. 19 Heyd, sec. 13-8s-7w. T.D. 9,161 ft., reaming.
Shell Pet. Corp. No. 20 Heyd, sec. 13-9s-7w. T.D. 5,275 ft.; W.O.C.
Shell Pet. Corp. No. 5 Tuten, sec. 13-9s-7w. T.D. 6,743 ft.; P.B. to 6,718 ft.; running 5-in. liner.
Shell Pet. Corp. No. 7 Stafford, sec. 18-9s-7w. R.U. (corrected).

Jeanerette—St. Mary Parish

Herton Oil Co. No. 1 Banta, sec. 49-13s-9e. Rig up.
Herton Oil Co. No. 1 Carter, sec. 33-13s-9e. R.U.
Herton Oil Co. No. 3 Roane, sec. 40-13s-9e. R.U.

Jennings—Acadia Parish

Lee Guthrie No. 2 Houssiere-Latrisle. Drlg. shale 1,880 ft.
Shell Pet. Corp. No. 1 Conover, sec. 40-9s-2w. Drlg. shale 3,200 ft.

Lafitte—Jefferson Parish

Texas Co. No. 3 Rigolettes, sec. 30-17s-24e. Drlg. shale and lime 7,000 ft.
Texas Co. No. 3 Lafitte, sec. 19-17s-24e. Drlg. shale and lime 8,998 ft.

Lake Hermitage—Plaquemines Parish

Gulf Ref. Co. No. 4 LaFourche Basin Levee sec. 15-18s-25e. Drlg. sand 3,275 ft.

Lake Barre—Terrebonne Parish

Texas Co. No. 37 Lake Barre State. R.U.
Texas Co. No. 39 State, sec. 20-12s-20e. Drlg. shale 1,739 ft.

Lake Pelto—Terrebonne Parish

Texas Co. No. 14 State, sec. 5-22s-18e. T.D. 7,346 ft.; P.B. and sidetracked; 6,686 ft.; running electric coring test.

Leesville—LaFourche Parish

Gulf Prod. Co. No. 8 Allen Land Co., sec. 21-21s-22e. Drlg. sand 2,617 ft.
Lincoln Oil Co. No. 1 Constentine, sec. 27-21s-22e. Rig up.
Texas Co. No. 43 Leesville (L.L.&R.), sec. 26-21s-22e. Coring sand showing oil at 4,122 ft.
Texas Co. No. 44 Leesville, sec. 27-21s-22e. Drlg. water sand 3,109 ft.

Roanoke—Jefferson Davis Parish

Glassell and Gulf Prod. Co. No. 1 T. A. Anding, sec. 2-9s-4w. Drlg. sand 3,352 ft.
Shell Pet. Corp. No. 2 Carter, sec. 1-9s-4w. T.D. 8,590 ft.; 7-in. csg. 8,567 ft.; I.P. 1,500 bbls. per day through ¾-in. choke.
Humble O. & R. Co. No. 2 Nelson H Thomas, sec. 11-9s-4w. Drlg. sandy shale 5,666 ft.
Humble O. & R. Co. No. 2-B De Vilbiss, sec. 11-9s-4e. T.D. 6,850 ft.; 7-in. csg. at 6,827 ft.

Port Barre—St. Landry Parish

Gulf Ref. Co. No. 1 Sibille, sec. 7-4s-7e. Drlg. lime 6,221 ft.
Pachoun Oil Co. No. 1 Gauden, Sec. 4-4s-4e. Coring sand 1,624 ft.
Pan American Prod. Co. No. 1 Watkins T.D. 5,026 ft.; P.B. to 2,850 ft.; fshg. for stuck drill stem.

St. Martinville—St. Martin Parish

Continental Oil Co. No. 1 fee, sec. 18-11s-6e. R.U.
Tide Water Oil Co. No. 3 Smedes, sec. 57-11s-4e. T.D. 8,714 ft.; 9⅝-in. csg. at 7,412 ft.; preparing to sidetrack.

Sorrento—Ascension Parish

Athens Oil Co. No. 4 United land, sec. 15-10s-4e. 10-in. csg. 1,240 ft.
Sorrento Oil Co. No. 1 Bernard, sec. 9-10s-4e. Derrick.

Starks—Calcasieu Parish

I. R. Welhite No. 1 Industrial Lbr. Co sec. 19-9s-12w. T.D. 4,363 ft.; P.B. to 3,600 ft.; sidetracking.

Sulphur—Calcasieu Parish

Union Sulphur Co. No. 321 fee, sec. 29-9s-10w. Drlg. rock 1,932 ft.

Tepetate—Acadia Parish

Continental Oil Co. No. 1 C. O. Ardoin sec. 28-7s-2w. T.D. 8,319 ft.; set 5⅝-in. csg. on bottom; to perforate.
Continental Oil Co. No. 2 Homeseekers, sec. 29-7s-2w. R.U.
Continental Oil Co. No. 2 C. Miller, sec. 29-7s-2w. Drlg. shale and shell 6,950 ft.
Continental Oil Co. No. 1 P. W. Miller, sec. 28-7s-2w. Drlg. shale 6,295 ft.
Loffland Bros. No. 1-A L. C. Bowles, sec. 28-7s-2w. Drlg. shale 6,265 ft.
Loffland Bros. No. 1-B L. C. Bowles, sec. 33-7s-2w. T.D. 1,468 ft.; 10-in. csg. on bottom; W.O.C.

Vinton—Calcasieu Parish

Wilson Broach Oil Co. No. 18 Strip, sec. 34-10s-12w. T.D. 4,347 ft.; T.A.
Gulf Prod. Co. No. 10 Gardner Est., sec. 33-10s-13w. T.D. 3,974 ft. in sand; I.P. 123 B.P.D.

White Castle—Iberville Parish

Shell Pet. Corp. No. 10 Wilbert, sec. 1 11s-12e. T.D. 6,466 ft.; reaming gas and S.W.

Miscellaneous Wildcats

TEXAS

Brazoria County

Gulf Prod. Co. No. 1 J. E. Fairfield, A Robinson Sur. T.D. 6,274 ft.; tested distillates on D.S.T.; 7-in. csg. 6,255 ft.
Strake Oil Corp. et al No. 1 D. K. Poole J. W. Harding Sur. Drlg. shale 2,539 ft.
Texas Gulf Prod. Co. No. 1 Sparks. Drlg.

Chambers County

Black Gold Oil Co. No. 1 Borrow, Ruben Borrow Sur. Drlg. shale 8,433 ft.

Calhoun County

Continental Oil Co. No. 2-A American Realty Co., Pedro Garcia Sur., Lot 1, Blk "C." T.D. 9,083 ft.; set 5⅝-in. csg. on bottom; csg. collapsed; plugged off the bottom of csg. at 9,010 ft.; recmtd. csg.
Crown Central Pet. Co. No. 1 M. C. Driscoll, Benito Morales Sur. T.D. 1,275 ft.; 10¾-in. csg. at 1,250 ft.
Humble O. & R. Co. No. 1 Patrick H Welder, Jose Maria Rios Sur. Drlg. shale 5,040 ft.

Colorado County

Coyle & Concord No. 1 fee, sec. 45, L&C N. Sur. T.D. 6,755 ft.; abd. 5,928 ft. in sidetracked hole.
G. W. Johnson No. 1 Drymalie, T. Coleman Sur. R.U.

Galveston County

Sun Oil Co. No. J. D. Hughes, W. M. C Baker Sur. T.D. 3,613 ft.; milling at 3,579 ft.

Grimes County

Crook Bros. No. 1 W. W. and J. C. Greir. Derrick.

Hardin County

Republic Prod.-Houston Oil Co. No. 1 A A. Burrell, A. A. Burrell Sur. No. 5-A. T.D. 7,778 ft.; P.B.; set whipstock at 3,598 ft.; drlg. shale 4,635 ft.

Jefferson County

Sun Oil Co. No. 1 Herbert & Broussard B. Blackman Sur., Abst. No. 2. T.D. 8,824 ft.; P.B. and sidetracked at 8,252 ft.; set whipstock at 7,493 ft.; P.B. to 7,245 ft.; set whipstock; milling out.
Smith and McDannald No. 1 Grennell Blk. 3, H.&T.C. Sur. Drlg. shale 4,750 ft.

Matagorda County

Continental Oil Co. No. 1 Peiffe, J. S Criswell Sur. T.D. 7,629 ft.; P.B. to 6,924 ft.; cutting and pulling 8⅝-in. csg.
Heimerich & Payne. No. 1 Hawkins, D. McCarthy Sur. T.D. 7,831 ft.; fshg.
H. M. Smith et al No. 2 Wadsworth Lot 23, Blk. 4, S. R. Fisher Sur. T.D. 1,300 ft.; 13⅜-in. csg. set 1,290 ft.; no report.
Sun Oil Co. No. 1 Craig, Thomas Williams Sur. Drlg. shale 5,641 ft.

Montgomery County

Chapman and Smith No. 1 Delta Land & Timber Co., T. Shepperd Sur. No. A-488. S.D. 2,559 ft.
Chapman & Smith No. 2 Delta Land & Timber Co., T. Shepherd Sur. S.D. 2,-591 ft.
Jack Frazier No. 1 Maxey, James Brown Sur. Drlg. shale and sand 3,360 ft.

Polk County

O. C. Davis No. 1 Knox, F. Chairs Sur. Drlg. shale 2,455 ft.
J. P. Lightfoot et al No. 1 Lynch Davidson, Houston County School Land Sur., Abst. No. 270. Drlg. shale 2,907 ft.

Washington County

W. D. Twichell et al No. 1 W. H. Hoxie, S. Ciampit Sur. Drlg. shale 1,461 ft.

Wharton County

Cockburn Oil Corp. No. 1 Conner, sec. 73, E.T.R.R. Sur. Coring shale 5,537 ft.
Pure Oil Co. No. 1 Paige, James Piric Sur. T.D. 7,756 ft.; changing drlg. mud.
Sterling O. & R. Co. No. 1 Agnes Genger, J. Scott Sur. R.U.
Texas Co. No. 1 Joseph Marek, I.&G.N Sur. No. 76. Drlg. shale and lime at 5,010 ft.

SOUTH LOUISIANA

Avoyelles Parish

Frost Oil Co. No. 1 Hinds Lbr. Co., sec. 3-3n-4e. R.U.

Calcasieu Parish

A. G. Oliphant No. 1 Calcasieu National Bank, sec. 23-10s-12w. Drlg. sand and shale 6,230 ft.
Union Sulphur Co. No. 2 Prairie Farm Land & Canal Co., sec. 2-11s-9w. T.D. 9,256 ft.; abd. 5,566 ft. in sidetracked hole.

Cameron Parish

Magnolia Pet. Corp. No. 1 Miami Corp., sec. 32-12s-8w. Abd. 8,490 ft.

West Feliciana Parish

Southern Minerals Corp. No. 1 Mary B. Wood, sec. 54-1s-4w. S.D. 1,138 ft.
C. L. Thompson No. 1 Percy, sec. 89-1s-4w. Drlg. sand and shale 1,604 ft.

Iberia Parish

Canal Oil Co. No. 1 Bolivar, sec. 2, in sec. 56-12s-7e. Topped salt 4,221 ft.; P.B. and sidetracked; drlg. 3,118 ft. in new hole.
Canal Oil Co. No. 3 Sabatier, sec. 54-12s-7e. Drlg.
Jefferson Lake Oil Co. No. 1 State, Twp. 12s-5e. T.D. 8,610 ft.; tested S.W.; preparing to perforate from 8,446-68 ft.
Jefferson Lake Oil Co. No. 322 State Lake Piegneur. T.D. 3,434 ft.; P.B. to 1,700 ft.; preparing to sidetrack.
Kitos Oil Co. No. 3-A Sealey, sec. 56-12s-7e. R.U.
Texas Co. No. 1 State Fausse Point. P.B. to 6,400 ft.; cmtd. whipstock and sidetracked at 5,781 ft.; drlg. shale 6,143 ft.

Jefferson Davis Parish

J. K. Lewis No. 1 Lockmore, sec. 32-7-6. T.D. 5,710 ft.; T.D. of sidetracked hole 5,510 ft.; hole cleaned of junk; reaming.
Shell Pet. Corp. No. 1 Lacassan, sec. 20-11s-5w. T.D. 9,802 ft.; fshg. at 6,034 ft.

St. James Parish

Shell Pet. Corp. No. 1 Colonial Sugar, sec. 5-12s-5e. Coring shale 5,219 ft.

St. Martin Parish

Southern Oil (S. C. Yingling et al) No. 1 State, sec. 13-9s-8w. T.D. 3,130 ft.; 7-in. csg. at 3,120 ft.; W.O.C.
Texas Co. No. 8 St. Martins Land sec. 17 8s-7e. Drlg. sandy shale 6,648 ft.

Plaquemines Parish

Southern Sulphur Co. No. 1 Manhattan Fruit Co., sec. 26-21s-30e. Drlg. shale 3,-525 ft.

Rapides Parish

Foster Oil Co. No. 1 J. F. Hogan, sec. 2-1s-2e. T.D. 1,815 ft.; 10-in. csg. at 1,-472 ft.; W.O.C.

Vernon Parish

Llano Cooperative Oil Co. No. 3 Llano Del Rio, sec. 7-1n-9w. S.D. 2,951 ft.

Terrebonne Parish

Shell Pet. Corp. No. 1 Realty Operators sec. 76, Sur. 103, 17s-17e. Abd. 10,155 ft.

LA.-ARK. WILDCATS

(Rotary operations unless otherwise designated)

NORTH LOUISIANA

Bienville Parish

DeSoto O. & G. Co. No. 1 C. R. Mewer. 270 ft. S, 400 ft. W, NE cor. NW SW sec. 9-16-10. Drlg. 2,525 ft.
Lide & Greer No. 1 Davis Bros. Lbr. Co., 660 ft. S and W, NE cor. SE sec. 13-16-5w. Fshg. 5,822 ft.

Bossier Parish

Geo. H. Bringhurst et al No. 1 Buckley. NE SW sec. 26-21-12. Drlg. 2,210 ft.
United Gas Pub. Ser. Co. No. 1-A A. J Murff, NW cor. sec. 17-17-11. Drlg. 2,884 ft.

Caddo Parish

Bayou State Oil Corp. No. 3 Brown, SE cor. sec. 28-22-15. Comp. 500,000 ft. gas, 968 ft.
Falcon Oil Co. No. 15 Deckson, NW SE sec. 27-20-15. Drlg. 950 ft.
Hillman et al No. 2 Muslow, NW SE sec. 32-21-15. Set 10-in. 60 ft.; drlg. 1,915 ft.
Juan et al No. 1 Hobbs, NE NE sec. 28-21-15. Set 10-in. 90 ft.; drlg. 1,600 ft.
Pyramid O. & G. Co. No. 1-A S. R. Wheeler, 1,320 ft. S, 1,500 ft. W, NE cor. sec. 16-18-16. Drlg. 3,240 ft.
Simplex Oil Co. No. 2 Natalie, C NW SE sec. 10-20-15. Comp., flowing 240 bbls. daily, 2,202 ft.
Sport Oil Corp. No. 1-D Muslow, SE cor. sec. 5-20-15. Drlg. 765 ft.

Caldwell Parish

Critchett & Woods No. 1 Kyles. NE cor SW NE sec. 18-11-3e. Drlg. 1,620 ft.

Claiborne Parish

W. C. Giothlin et al No. 1 Brinker, SW cor. SE sec. 19-23-4w. S.D. 3,196 ft.
E. T. Oakes No. 1 H. W. Patton Est., 660 ft. S and W, NE cor. sec. 1-20-8w. Fishing for D.S., 4,342 ft.
Triangle Drlg. Co. No. 1 Kilpatrick, 660 ft. N and E cen. sec. 7-19-5. O.W.D.D. 4,458 ft.
United Gas Public Service Co. No. 2 Duffett, 660 ft. N and 1,980 ft. E, SW cor sec. 31-20-5. Reaming to bottom 5,655 ft.

Concordia Parish

Zeni Oil Co. No. 1 Young, 1,200 ft. W, 100 ft. N, SE cor. sec. 28-6n-8e. S.D. 1,120 ft.

De Soto Parish

S. S. Alexander No. 1 G. R. Stell, 330 ft. S and W, NE cor. sec. 5-12-16. S.D. 5,595 ft.
A. G. Halbach et al No. 1 Staton, 150 ft. N and E, SW cor. SE sec. 29-13-14. S.D. 3,204 ft.
R. C. Payne No. 1 Harris, NE cor. SW SE sec. 11-13-14. Set 10-in. 27 ft.
Union Pet. Co. No. 1 Hill, sec. 3-10-13. S.D. 1,400 ft.
J. K. Wodley et al No. 2 Logan Oil Co. NW sec. 16-10-12. Set 7-in. 3,065 ft.; T.D. 3,184 ft.

Grant Parish

Alexander et al No. 1 Maxwell, sec. 9-9-1e. W.O.S.R. 1,538 ft.
Taw Oil Co. No. 1 Bradford, NE cor. NW sec. 16-9-1e. Set 10-in. 60 ft.

Jackson Parish

Geo. W. Zeigan No. 4 La. Cent. Lbr. Co., NW SE sec. 25-14-2w. Set 12½-in. csg. 63 ft.; fshg. for drill bit 1,465 ft.
Geo. W. Zeigan No. 5 La. Cent. Lbr. Co., SW NE sec. 13-14-2w; set 12½-in. csg. 63 ft.; T.D. 1,750 ft.

La Salle Parish

Montague Oil Co. No. 7-A Zenonia Lbr. Co., NE cor. sec. 10-9-1e. Set 10-in. 40 ft.; drlg. 1,500 ft.; arrng. set 7-in. csg. 1,520 ft.

Lincoln Parish

Ark.-La. Gas Co. No. 1 C. E. Causey, NW cor. NE NW sec. 32-19-2w. Set 10¾-in. 827 ft.
Caldwell Land & Timber Co. No. 1 J. B. Hammons, 330 ft. S and E, NW cor. SE SW sec. 20-18-1w. Set 15½-in. 100 ft.
Herman L. Brown et al No. 1 S. Gardner, 330 ft. N, 380 ft. E, SW cor. NW NE sec. 10-17-4w. S.D. 4,587 ft.

Morehouse Parish

J. B. Collins et al No. 1 E. M. Clarke. SE NE sec. 10-20-7e. Rigging up.
Grecian Bend Oil Co. No. 1 Sandidge, NE cor. sec. 2-20-4e. Set 6-in. 2,137 ft.
United Gas Pub. Ser. Co. No. 32 Crossett, NE SE sec. 27-21-4e. Set 7-in. 2,111 ft.

Ouachita Parish

United Gas Pub. Ser. Co. No. 86 fee. SE cor. SE sec. 31-19-4e. Set 7-in. 2,148 ft.

Richland Parish

J. S. Morrisey No. 1 Jones. 1,293 ft. S 636 ft. E, SW cor. sec. 15-18-7e. Coring 1,274 ft.
Arthur Wray No. 1 Slocum, 2,436 ft. S 560 ft. W, NE cor. sec. 10-17-6e. S.D. 1,200 ft.

Sabine Parish

J. E. Doughtie No. 2 Edwards, NW cor NW sec. 29-9-13. Set 10-in. csg. 100 ft.; set 7-in. csg. 1,527 ft.
M. C. Forsman No. 1 Patrick, NE SW sec. 21-9-13. Set 8-in. 75 ft.
J. E. Nicholson No. 1 Cassell, 330 ft. S and W, NE cor. NW SW sec. 25-9-14. S.D. 2,110 ft.
Posey Sisters Oil Co. No. 2 A. J. Burkett, C NE NE sec. 10-9-13. Drlg. 1,815 ft.
Claude H. Smith No. 1 Whitney Corp., 330 ft. S, 990 ft. W, NE cor. sec. 19-10-13 Drlg. 1,450 ft.
A. H. Tarver No. 2 Baker, NW cor. NE sec. 26-8-12. Drlg. lime 4,300 ft.
Lee Whitehurst No. 1 Cassell, 440 ft. S and W, NE cor. NW sec. 30-9-13. W.O. S.R. 2,100 ft.
Whitehurst & Myers No. 1 Paul, SE cor. SW sec. 24-9-14. Set 10-in. csg. 42 ft.

Union Parish

Boucher & Pace No. 1 Frost-Johnson, NE NE sec. 27-21-1e. Set 10-in. 890 ft.
Interstate Nat. Gas Co. No. 44 fee, NW SW sec. 7-20-4e. Set 6-in. 2,086 ft.
Interstate Nat. Gas Co. No. 46 fee, SE NE sec. 25-20-3e. R.U.
Southern Carbon Co. No. 8 Grayling, NE SW sec. 28-21-4e. Set 10-in. 175 ft.; drlg. 2,070 ft.

Vernon Parish

Llano Del Rio Co. No. 2 Gulf Lbr. Co., 1,285 ft. S, 1,000 ft. W, NE cor. sec. 7-1n-9w. S.D. 2,960 ft.

Webster Parish

J. L. Edwards No. 1 Hooper, 330 ft. S and E, NW cor. SW sec. 8-17-9. Reaming 1,502 ft.
J. P. Evans et al No. 1 T. Crichton, NE SE sec. 35-18-9. Set 12½-in. 156 ft.; drlg. 1,400 ft.
Ohio Oil Co. No. 1 R. L. Holloway, 660 ft. S, 760 ft. W, C sec. 23-21-10. Drlg. 6,350 ft.

EAST TEXAS

(Border Counties)

Cass County

American Liberty Oil Co. No. 1 D & Maxie, John Collum Sur. Drlg. 5,129 ft.
American Liberty Oil Co. No. 1 Marcus Rembo, J. H. Reeves Sur. M.I. rig.

United Gas Pub. Ser. Co. No. 1 J. B Jones Unit, Ben Murray Sur. Drlg. 5,572 ft.

United Gas Pub. Ser. Co. No. 3 J. B. Jones Unit, Ben Murray Sur. Drlg. 5,985 ft.

Harrison County

R. C. Payne et al's No. 1 Lowery, H. D Spain Sur. P.B. to 3,524 ft.

Marion County

Ed S. Holman's No. 1 Henderson, R. Bennington Sur. P.B. to 2,443 ft.

Panola County

George Hudson et al's No. 1 J. F Wall - McGeary Sur. Set 8-in. 40 ft.; fshg. for core bbl. at 2,345 ft.

Geo. Le Grand No. 1 P. J. Wardleigh, A Thompson Sur. Set 10-in. 62 ft.

ARKANSAS

Arkansas County

Ark. O. & G. Co. No. 3 Fischer, 250 ft. S, 200 ft. E, NW cor. NE NW sec. 6-4w. R.U.; W.O.

Ashley County

Seaboard Oil Corp. No. 2 fee, NW cor. NW NE sec. 23-17-4. Coring 2,281 ft.

Clark County

Boris Tripanoff, tr., No. 1 W. Gibbons sec. 27-8-18. Arranging to test 557 ft.

Hempstead County

Dixie Drlg. Co. No. 1 Wheatley, 330 ft. S 30 ft. E, NW cor. SW NE sec. 14-11-26 R.U. and S.D.

Fitzwater et al No. 2 Lafferty, C NW sec. 17-14-24. Arranging set csg. 1,986 ft.

Murdock-May & Easton No. 1 Conway est., 330 ft. N and E, SW cor. NW SW sec 17-14-24. Set 12½-in. 80 ft.; S.D. 120 ft.

LaFayette County

Earl F. Fox No. 3 Coleman Bros., NE NE sec. 30-16-24. Drlg. 3,241 ft.

Erwin & Leach No. 3 Bodcaw Lbr. Co., 330 ft. S and E, NW cor. sec. 20-16-13. D.S. stuck 4,150 ft.

Joe Modisett No. 1 Red River Lbr Co C SW SW sec. 21-19-14. Drlg. 2,331 ft.

Transportation Pet. Co. No. 1 Cockran. 330 ft. S and W, NE cor. SE sec. 26-19-25. Bailing to test 3,670 ft.

Miller County

Odell Hinson No. 1 Montana Realty Co., NE cor. NW NW sec. 3-17-28. R.U.

King Oil Corp. No. 1 G W Crank SW NE sec. 19-16-25. S.D.; W.O. 3,906 ft.; (corrected).

C. V. Lenz No. 8 Dale, sec. 24-15-26. R.U.

L. H. Mahon et al No. 1 Miller Land & Timber Co., SW cor. SE sec. 29-18-27. S.D. 1,812 ft.

Ouachita County

Grigsby & Aarner No. 1 Burris, 330 ft. N and E, SW cor. NW NE sec. 19-18-19. D.&A. 4,017 ft.

L. L. McDonald No. 1 Langley, 330 ft. N and E, SW cor. NE SW sec. 19-15-16. S.D. 1,700 ft.

Phillips Pet. Co. No. 1 J. D. Reynolds, 330 ft. N and W, SE cor. SE NW sec. 27-15-15. Drlg. 3,705 ft.

J. D. Reynolds No. 1 McKensie, 204 ft. S, 300 ft. W, NE cor. SE SW sec. 36-15-16. W.O.S.R. 1,970 ft.

W. B. Street, trustee No. 1 Roth & Cartier, 330 ft. N and E, SW cor. SW NE. S.D. 2,202 ft.

Union County

Arkansas Southern Oil Co. No. 1 F. R. Laney, sec. 30-19-16.
Installing larger rig. 175 ft.

J. C. Bucbee No. 1 Ezzell, SW cor. NE NW sec. 13-17-15. Drlg. 2,330 ft.

J. C. Buckbee, tr. No. 1 Sloan, 330 ft. N and E, SW cor. SE NW. W.O.S.R. 2,-160 ft.

F. C. Henderson No. 1 J. M. Sheppard, C NE NW sec. 35-17-15. D.&A. 2,192 ft.

Ohio Oil Co. No. 4 R. Furlough, SE NW sec. 12-17-14. Set 16-in. 221 ft.

Ohio Oil Co. No. 6 R. Pumphrey, 520 ft. S, 50 ft. W, NE cor. SE NW sec. 12-17-14. Comp. 310 B.P.D. 3,173 ft.

LA.-ARK. PROVEN
NORTH LOUISIANA

Caddo—Rodessa

Ark.-La. Gas Co. No. 8 Rodessa O. & Land Co., 330 ft. S and E., NW cor. SE NE sec. 22-23-16. Drlg. 5,812 ft.

Ark.-La. Gas Co. No. 9 Rodessa O. & Land Co., 330 ft. S, 620 ft. W, NE cor. SE SE sec. 13-23-16. Coring 6,000 ft.

Ark.-La. Gas Co. No. 10 Rodessa O. & Land Co., 330 ft. S and W, NE cor. SE NE sec. 23-23-16. Drlg. 5,595 ft.

Ark.-La. Gas Co. No. 11 Rodessa Oil & Land Co., NW cor. NE sec. 23-23-16. Drlg. 4,392 ft.

Ark-La Gas Co. No. 9-A Rodessa Oil & Land Co., SE NE sec. 22-23-16. R.U.

Bartex Pipe Line Co. No. 2 Norton Est., 330 ft. N and E, SW cor. NW NW sec. 17-23-15. Drlg. 5,606 ft.

Bartex Pipe Line Co. No. 3 Norton Est., SE NE sec. 18-23-15. Set 10¾-in. csg. 2,305 ft.

Bartex Pipe Line Co. No. 1 Robinson, C E½ NE SE sec. 18-23-15. Coring 5,930 ft.

Bartex Pipe Line Co. No. 2 Robinson, center W½ NW SW sec. 17-23-15. Coring 6,015 ft.

Bartex Pipe Line Co. No. 2 Rodessa Oil & Land Co., NE SE sec. 13-23-15. R.U.

J. Edward Jones No. 1 Neugent, 25 ft. N and E, SW cor. Lot 14, Blk. 13, sec. 33-23-16. Testing 6,005 ft.

Haynes Prod. Co. No. 3 Tyson, NE cor. NW NE sec. 14-23-16. Set 7-in. csg. at 5,865 ft.

Haynes Prod. Co. No. 4 Tyson, NW cor. NW NE sec. 14-23-16. Drlg. 5,374 ft.

R. W. Norton No. 1 J. Elder Unit, NE cor. sec. 23-23-16. Set 10¾-in. at 2,170 ft.; drlg. 4,707 ft.

Haynes Prod. Co. No. 7 Sexton, NW cor SW NE sec. 14-23-16. Comp. 86 bbls. per hr., 6,078 ft.

Haynes Prod. Co. No. 8 Sexton, SW cor. NW SE sec. 14-23-16. Comp. 184 bbls. per hr., 6,037 ft.

Lyons & Neely No. 1 Blaxton, C Lot 11 & 12, Blk. 22, sec. 23-23-16. Drlg. 200 ft.

M. H. Marr No. 3 Hunter, NW cor. SW sec 13-23-16. Drlg. 4,504 ft.

M. H. Marr No. 4 Hunter, 330 ft. S, 1,316 ft. E, NW cor. SW sec. 13-23-16. P.B. from 6,052 ft.

M. H. Marr No. 1 Peak, SW SE sec. 11-23-16. Set 16-in. 256 ft.; drlg. 1,420 ft.

R. W. Norton No. 1 Spearman Unit, 1,980 ft. N, 1,155 ft. W, SE cor. sec. 18-23-15. Coring 6,575 ft.

R. W. Norton No. 1 Atkins, 330 ft. N and W, SE cor. NE NE sec. 18-23-15. Coring 5,983 ft.

R. W. Norton No. 1 Slattery, NW cor. sec. 28-23-16. Set 13⅜-in. 307 ft.; drlg. 1,944 ft.

R. W. Norton No. 3 Tyson heirs, 330 ft. N and E, SW cor. SE NW sec. 13-23-16. Set. 7-in. csg. 6,049 ft.; drlg. 6,065 ft.

Pelican O. & Gasoline Co. No. 13 Sexton, 330 ft. N and W, SE cor. sec. 14-23-16. Comp. 35 bbls. per hr., 6,010 ft.

Travis et al No. 1 Raney, 990 ft. W of C sec. 17-23-15. Drlg. 4,130 ft.

Tri-State-Williams & Peterbaugh No. 1 Ellis, Lot 2, Blk. 20, Townsite, sec. 23-23-16. Set 10¾-in. csg. 2,030 ft.

United Gas Pub. Ser. Co. No. 5 Ardis & Co., SW SE sec. 14-23-16. Drlg. 3,506 ft.

United Gas Pub. Ser. Co. No. 6 Ardis & Co., SE cor. sec. 14-23-16. R.U.

United Gas Pub. Ser. Co. No. 5 Bremer Unit, 620 ft. N, 148 ft. W, C sec. 22-23-16. Comp. 45 bbls. per hr., 6,020 ft.

United Gas Pub. Ser. Co. No. 2 Brewer Unit, 657 ft. S, 578 ft. E, NW cor. sec. 29-23-16. Coring 6,026 ft.

United Gas Pub. Ser. Co. No. 1 Gipson Unit, NE SW sec. 15-23-16. Drlg. 4,052 ft.

United Gas Pub. Ser. Co. No. 1 Harris, 333 ft. S, 1,133 ft. W, NE cor. sec. 15-23-16. Comp. 31 bbls. per hr. 6,020 ft.

United Gas Pub. Ser. Co. No. 2 V. I. Miller, 330 ft. S, 990 ft. E, NW cor. sec. 14-23-16. Drlg. 6,015 ft.

United Gas Pub. Ser. Co. No. 1 M. L. Pitts, 990 ft. N, 338 ft. E, SW cor. sec. 13-23-16. Coring 6,081 ft.

United Gas Pub. Ser. Co. No. 2 M. L. Pitts Unit, NE SW sec. 13-23-16. Set 10¾-in. csg. 2,200 ft.; drlg. 4,133 ft.

United Gas Pub. Ser. Co. No. 1 N. S Spearman unit, sec. 18-23-15. Set 7-in. csg. 6,007 ft.; T.D. 6,035 ft.

United Gas Public Service Co. No. 2 Spearman, 427 ft. S, 660 ft. E, NW corner sec 22-23-16. Comp. 79 bbls. per hr., 6,000 ft.

Untied Gas Pub. Ser. Co. No. 2 Thomas Unit, NE cor. sec. 23-23-16. Drlg. 4,110 ft.

United Gas Pub. Ser. Co. No. 6 Tyson Unit, 306 ft. S, 318 ft. E, NW cor. sec. 13-23-16. Drlg. 5,386 ft.

United Gas Pub. Ser. Co. No. 7 Tyson Unit, 345 ft. N, 336 ft. W, SE cor. sec. 11-23-16. Set 7-in. 5,991 ft.; T.D. 6,044 ft.

United Gas Pub. Ser. Co. No. 8 Tyson Unit, SW NW sec. 13-23-16. Set 10¾-in. at 2,196 ft.; drlg. 2,606 ft.

United Gas Pub. Ser. Co. No. 7 Rodessa Oil & Land Co., 231 ft. N, 330 ft. W, SE cor. sec. 15-23-16. Drlg. 5,950 ft.

United Gas Pub. Ser. Co. No. 11 Rodessa Oil & Land Co., NW cor. sec. 23-23-16. Drlg. 3,973 ft.

United Gas Pub. Ser. Co. No. 2 I. L. Young, 1,944 ft. N, 605 ft. W, SE cor. sec. 21-23-16. Drlg. 4,928 ft.

Sabine Parish—Zwolle

Ellis Prod. Co. No. 1 Williams, 330 ft. S and W, NE cor. SE NE sec. 23-7-11. Set 6-in. 2,605 ft.

E. C. TEXAS WILDCATS

Week Ending March 14

Bowie County

Woodley Pet. Co. No. 1 Lumpkin. Drlg. 930 ft.

Grayson County

Olson Drlg. Co. No. 1 Southwestern Life Ins. Co., J. C. Jamison Sur., 6 miles NW of Denison. Elev. 767 ft.; top sand 4,-432 ft.; drlg. 4,712 ft.

Franklin County

W. C. Windsor and Humble O. & R. Co. No. 1 King & Hughes, in O. James Sur., 1½ mi. SW of Talco. Drlg. 4,178 ft.

Gregg County

John Hoover No. 1 Williams, David Hill Sur. Drlg. 3,875 ft.

Lamar County

J. Forrester et al No. 1 J. E. Woodward, L. Highton Sur., but in J. W. Woodward Sur., 1 mi. E of Mintel. Drlg. 2,-867 ft.

Limestone County

C. L. Lytle No. 1 J. L. Thompson, P. Varella Sur., Mexia field. Drlg. 4,829 ft.

Navarro County

W. A. Reiter et al No. 1 T. W. Bounds, 330 ft. from N and E of H.T.&B. Sur. Derrick.

Nacogdoches County

Overtex Oil Co. No. 1 Hazelwood, J. L. Ewing Sur., 15 mi. S of Nacogdoches. Drlg. 2,020 ft.

Navarro County

Thompson & Sitton No. 3 Pugh, Joseph Smith Sur., Powell field. T.D. 1,716 ft.; P.B. 1,100 ft.; S.D.

Red River County

Williams et al No. 1 L. and O. Roberts, James Bankston Sur., 2 miles NE of Annona. Elev. 396 ft.; drlg. 470 ft.

Rockwall County

W. H. Carlin No. 1 N. F. Lofland, ¾ mile W of Rockwall, Bowles Sur. S.D. 750 ft.; test failed.

Dodd et al No. 1 Lofland. T.D. 750 ft.

Rusk County

Alex McCutchin et al No. 1 B. Moyers, 330 ft. out of SW cor. of R. Lanham Sur., E of gas area in Rusk Co.

McCallum et al No. 1 E. C. Gary, John Piburn Sur., 5 miles S of Henderson. Elev. 338 ft.; drlg. 3,276 ft.

Pure Oil Co. No. 1 W. H. Faulkner, Wm. Elliott Sur., S of Concord. Material.

J. W. Shipman et al No. 1 Citizens Natl. Bank, NE cor. of 125-ac. tract, J. J Y'Barbo Sur., 4 miles NE of Henderson. Coring 3,506 ft.

Smith County

Beard et al No. 1 Hally, M. Kinsey Sur., 2 mi. SE of Chapel Hill. Elev. 478 ft.; drlg. 2,870 ft.

Thompson & Colby No. 1 W. P. Walsh, 1,600 ft. from N and 330 ft. from W line of S. Barnett Sur., 6½ miles NE of Tyler. Drlg. 1,000 ft.

Titus County

Howse, Thompson & Peveto No. 1 C. M. Carr, North M. V. Delgado Sur., 2,060 ft. from easterly E line and 1,888 ft. from northerly N line of Sur., 1¼ miles E of Talco. T.D. 4,208 ft.; swbng.; showing for a small well.

Humble O. & R. Co. No. 1 M. B. Groves, Ben Jones Sur. Pecan Gap 1,605-42 ft.; cut fault at 1,642 ft.; drlg. 2,500 ft.

Jule Alford, tr., No. 1 W. D. Fry, 330 ft. out of most northerly SE cor. of tract, I.P. Stern Sur., 1½ mi. S of Carr well. Drk.

Lucky Strike Oil Co. No. 1 W. D. Clark, I. P. Stern Sur., 3¼ mi. SE of Talco. Location.

O'Neal, tr. No. 1 O. C. Lillianstern, C of 80 ac., Wm. Canon Sur., 4 mi. SE of Carr well. Drk.

S. W. TEXAS WILDCATS

Week Ending March 14

Atascosa County

Atascosa Trust No. 1 Domsch, 160 ft. S line, 300 ft. E line, 152-ac. lease, J. T. Russell Sur. No. 1,222. Drlg. 2,042 ft.

Cliff Oil Co. (McIntyre) No. 1 Joint Stock Land Bank Co., 1,104 ft. SW line, 3,700 ft. SE line, Woodlief Sur., 246. T.D. 3,180 ft.; S.D.

Bee County

Mills Bennett Prod. Co. No. 1 Mengers, cen. 50-ac. tract, W. R. Ryan tract, Allen Sur. M.I.R.

H. A. Pressey No. 1 Hicks, 1,450 ft. of S line, 150 ft. of W line, lease, J. Uranga grant. Drlg. 120 ft.

Bexar County

J. Dupree No. 1 Coffey, Rodriguez Sur. T.D. 1,123 ft.; bailing.

Joe Deupree No. 1 Winters, F. Roderiguez Sur. M.I.M.

H. A. Pagenkopf No. 1 Ritteman, 2,500 ft. E line, 500 ft. N line, C. Texada Sur. Coring 2,161 ft.

H. V. Schumaker No. 1 Gillette, 465 ft. White road, 235 ft. N line, 49-ac. tract, de Alamis Sur. No. 20. Drlg. 478 ft.

Brooks County

California Co. No. 1 B. Garcia, 465 ft. N and W lines lease, B. Garcia tract. Salinas Sur. Set csg. 4,041 ft.; T.D. 4,-455 ft.

Dick Young No. 1 Singer, 50 ft. E line, 660 ft. N line, NW¼ SE¼, Sur. 313. Sand 917-19 ft.; 600 ft. O.I.H.; fshg.

Dewitt County

Hill Bros. & Koontz No. 1 Herman Riddle, 450 ft. S line, 330 ft. W line, 535-ac. tr., Santos Sur. Drlg. 4,660 ft.

Universal Oil, Gas & Mining Co. No. 1 Schuebel. 330 ft. from S and W lines of tr., Fitzgeral grant. T.D. 887 ft.; S.D.

Duval County

Chas. Daubert No. 1 Kreis, 2,600 ft. N line, 2,700 ft. E line, Sur. 518. Drlg. 3,260 ft.

Frank Gravis No. 1 C. K. Gravis, 1,650 ft. SE line, 990 ft. SW line, Sur. 250. Reaming 4,300 ft.

Santa Clara Oil Co. (Atkins & O'Neil) No. 1 Glasscock, 3,945 ft. E line, 9,085 ft. S line, Book ranch, Concepcion grant. Drlg. 5,600 ft.

Edwards County

Paul Teas No. 1 Stewart, C SE¼ sec. 2, G.C.&S.F. Sur. Drlg. 2,812 ft.

Goliad County

Cotton Belt O. & G. Co. No. 1 Lutenbacher, 330 ft. S and W lines, Blk. 35, Goliad Townsite. S.D. 530 ft.

Thompson Drlg. Co. No. 1 J. E. Pettus, 2,750 ft. S line, 750 ft. creek, Barbo Sur. No. 51. Drlg. 2,121 ft.

Hidalgo County

Gulf States Oil Co. No. 1 Delta Orchards, 550 ft. from N line, 400 ft. W line, Lot 2, Blk. 73, Las Mestanas grant. T.D. 6,-808 ft.; W.O. orders.

Maddox & Tatum No. 1 John Shary, Tr. 48-2, Porc. 53, jurisdiction of Reynosa. T.D. 6,006 ft.; D.&A.

Quintana Petroleum Co. No. 1 John C. Engleman, Lot 16, Blk. 94, Las Mestanas grant. T.D. 4,990 ft.; reaming.

Dayle Smith No. 1 Fairbanks & Young, Blk. 44, Por. 46, jurisdiction of Reynosa. T.D. 1,700 ft.; S.D.

Jim Hogg County

S. L. Miller No. 2 Yeager, 777 ft. S line, 150 ft. E line, Blk. 6, Sur. 29, M.I.M.

Rankin Oil Co. No. 1 Vela, Lot 6, Sur. 5. Drlg. 1,962 ft.

Jim Wells County

O. W. Killam No. 1 Reynolds, C S half Sur. 28. Spudded in.

Karnes County

J. Owens and MacDowell No. 1 Ruhman, Butler, Sur. Spudded in.

Kerr County

Auld and Evans' No. 1 Heffner, 660 ft. N line, 330 ft. E line, Sec. 13, B.S.&F. Sur S.D. 1,451 ft.

Eastland Oil Co. No. 7 Love, 660 ft. N Evans & Gant No. 1 Love, Martinez Sur. No. 1,594. T.D. 1,500 ft.; standing.

Live Oak County

Dirks Bros. No. 1 Dougherty, 330 ft. NW line, 960 ft. NE line, 320-ac. tract Beagle Sur. Coring 4,493 ft.

R. H. Feltner No. 1 J. T. Carter, 1,847 ft. NW line, 350 ft. NE line, 120-ac. tract, sec. 319, S.D. 2,962 ft.

L. W. Steiren No. 1 Smith, T. B. Reese Sur. T.D. 3,513 ft.; D.&A.

McMullen County

Darby Pet. Corp. No. 3-B Hagist, 330 ft. S line, 990 ft. W line, Sur. 187, M.I.M.

F. Dayvault No. 1 Matula, 150 ft. S line, 2,462 ft. E line tr., Jas. Garner Sur. T.D. 1,023 ft.; standing.

Magnolia Pet. Co. No. 1 Kincaid, 2,310 ft. W line, 330 ft. N line, Sur. 86. Coring 3,047 ft.

Earl Rowe No. 1 Lee, 330 ft. S and W lines, NE¼ SE ¼ sec. 84. Drlg. 2,324 ft.

Whisenant & Trenchard No. 1 Roos Bros., C SE¼ SE, Sur. 93. Drlg. 882 ft.

Medina County

W. C. Campbell's No. 1 McMenemy, 160 ft. S and W lines, Sur. 33. P.B. 2,180 ft.; W.O.C.

Nueces County

Allen & McCormick No. 1 McBurnett, 660 ft. N line, 330 ft. E line, Lot 2, Robert Shallert ranch. Set sur. csg.; W.O.C.

Coker & Lee Bros. No. 1 Geistman, 330 ft. N line, 660 ft. W line, 60-ac. tract, J. R. Ward Sur. No. 316. Drlg. 3,170 ft.

Santa Clara Oil Co. (Atkins & O'Neil) No. 1 Cooke, 990 ft. N line, 330 ft. W line, sec. 14, R.U.; drlg. wtr. well.

San Patricio County

Benedum & Trees Oil Co. No. 1 Jones, 1,650 ft. E line, 990 ft. S line, NW¼ sec. 65. M.I.M.

Benedum & Trees Oil Co. No. 2 Welder, sec. 19. Testing 4,561-75 ft.; T.S. 4,562 ft.

Santa Clara Oil Co. (Atkins & O'Neil) No. 4 Welder, 2,300 ft. SE line, 1,791 ft. NE line, 1,250-ac. tract, Villareal Sur. Drlg. 1,540 ft.

Stanolind Oil & Gas Co. No. 1 Floerke, 150 ft. NE line, 1,320 ft. SE line, Lot 5. Drlg. 6,327 ft.

Willis Storm No. 1-A Nancy Hobbs, 622 ft. NW and SW lines, 30-ac. tr. R.U.

Starr County

J. H. Clopton No. 2 Kelsey-Bass, rec. 377. T.D. 750 ft.; D.&A.

J. H. Clopton No. 3 Kelsey-Bass, sec. 357. Set csg. 22 ft.; W.O.C.

Webb County

Austin & Vernon's No. 1 Jeffries, 150 ft. NE line 1,170 ft. SE line, Blk. 18, Sur 1,453. Drlg. 1,211 ft.

Southwest Drlg. Co. No. 1 R. Lopez, 330 ft. S and W lines, NE¼, Sur. 139. Coring 3,057 ft.

Zavalla County

Buttram Pet. Co. No. 1 White Cotton, 2,-340 ft. W line 330 ft. N line, A.B.&M. Sur. No. 1. R.U.

Leona Oil Co. and Witherspoon Oil Co. No. 1 George West, 2,665 ft. N line, 330 ft. E line, C. Bustillo Sur. No. 1. Set sur. csg.; S.D.

Zapata County

Murt Cullinan No. 1-A Gutierrez, Blk. 3, Share 2, Comitas grant. R.U.

Ivan Howard No. 1 Martinez, 4,950 ft. SW line, 330 ft. NW line, Blk. 5, Sur. 206. M.I.M.

J. J. O'Hern's No. 1 Raymond, 330 ft. NW line, 330 ft. NE line Blk. 5, Share B, Por. 27. Drlg. 2,465 ft.

S. W. TEXAS PROVEN

Week Ending March 14

Dirks—Bee County

Heyser, Heard & Walton No. 12 Young, 226 ft. NW No. 4, F. Rawlins Sur., Abst. 290. R.U.

Texas Co. No. 18 Young, Butler Sur. T.D. 3,922 ft.; P.B. 2,441 ft.; W.O.C.

Texas Co. No. 21 Young, Butler Sur. Comp. 11 B.P.H. on ¼-in. choke; T.D. 3,950 ft.

Plummer—Bee County

C. Echols No. 1 Plummer, 391 ft. SW line, 150 ft. SE line, F. J. Chessman Sur. S.D. 1,700 ft.

Ray—Bee County

Duncan & Perkins No. 2-A Campbell, B.& B. Sur. Set csg. on sand; W.O.C.

Eckert—Bexar County

Alamo Nat. Gas Co. No. 1 Minnie Coreth, Sur. 49. T.D.; chalk 1,091 ft.; S.D.

Dale—Caldwell County

Ogden & Reed No. 2 Vickery, 550 ft. NE line, S. Damon Sur. T.D. 1,923 ft.; Serp.; S.O.

Salt Flat—Caldwell County

Witherspoon Oil Co. No. 1 Tiller, 175 ft. N and W lines tract. G. Hinds Sur. Set csg. 1,240 ft.; W.O.C.

Eagle Hill—Duval County

Morse Oil Co. No. 2 Hagist, 430 ft. E ... No. 1, Sur. 6. T.D. 2,174 ft.; coring deeper.

Government Wells Pool—Duval County

Central Producers, Inc., No. 4-A Wendt, 990 ft. E line, 330 ft. N line, Sur. 43. Comp. jetting 85 B.P.D.; T.D. 2,309 ft.

Hoffman—Duval County

Duval Oil Corp. No. 1 D. Ruiz, 330 ft. N line, 990 ft. E line, Sur. 119. Comp. at 2,685 ft. for gasser.

Gorham & Yoakam and Gem Oil Co. No. 1 Bishop Duval Land Co., 330 ft. S and W lines, sec. 70. T.D. 2,837 ft.; abd.

Hamill & Smith No. 1 B.C.C., 330 ft. N and E lines, NW¼ NE¼ Sur. 70. drlg. 1,820 ft.

Plymouth Oil Co. No. 1 Cuellar, 330 ft NW and NE lines, tr., Sur. 117. R.U.

Porter & Stevens No. 1 Sutherland, 330 ft. S and E lines, Sur. 126. Drlg. 1,590 ft.

Rogers & Rogers No. 2 Sutherland, 1,070 ft. S and E lines, E½ Sur. 120. M.I.M.

Rogers & Rogers Drlg. Co. No. 2 Hoffman, 330 ft. E line, 1,698.5 ft. S line, 640-ac. tr., Sur. 118. T.D. 2,903 ft.; swbng.

Standard Oil Co. of Kansas, 330 ft. SW of N line, 80-ac. tr., Sur. 118. Set sur. csg.; W.O.C.

Loma Novia—Duval County

Bridwell Oil Co. No. 6 B.C.C., Sur. 76. Comp. 655 B.P.D. on ½-in. ck.; T.D. 2,626 ft.

Bridwell Oil Co. No. 7 B.C.C., Sur. 76. Comp.; no gauge.

Bridwell Oil Co. No. 13 B.C.C., SW¼ Sur. 76. Comp.; no gauge.

Bridwell Oil Co. No. 14 B.C.C., 990 ft. E line, 330 ft. S line, SW¼ Sur. 76. Set csg. on sand; W.O.C.

Bridwell Oil Co. No. 15 B.C.C., Sur. 76. M.I.M.

Bridwell Oil Co. No. 1-C Hubbard, 330 ft. S and E lines, NE¼ SW¼, Sur. 75. Sand 2,553-62 ft.; comp.; est. 288 B.P.D. on ½-in. ck.

Bridwell Oil Co. No. 2-C Hubbard, Sur. 75. Set csg. on sand; W.O.C.

Duval Oil Corp. No. 12 B.C.C., 1,650 ft. N line, 330 ft. E line, Sur. 59. Comp.; 32 B.P.H. on ¼-in. ck.; sand 2,523-47 ft.

Duval Oil Corp. No. 13 B.C.C., 330 ft. S and E lines, S½ N½, Sur. 59. Coring 2,500 ft.

Duval Oil Corp. No. 14 B.C.C., 330 ft. N line, 990 ft. E line, S½ N½, Sur. 59. Set csg. 2,526 ft.; W.O.C.

Frank Gravis No. 3 Flodin, Sur. 78. R.U.

Frank Gravis No. 2 Tulin, Blk. 1, Sur. 78. T.D. 2,586 ft.; comp.; 30 B.P.H.

Hamil, Smith & Ogden No. 13 Hubbard, 330 ft. N and E lines, NE¼ SE¼ sec. 77. Derrick.

Hamil, Smith & Ogden No. 16 Hubbard, 330 ft. SE cor., SW¼ SW¼ Sur. 77. Sand 2,669-82 ft.; testing.

Hamil, Smith & Ogden No. 20 Hubbard, 330 ft. NW cor., NE¼ SW¼ Sur. 77. Derrick.

Highland Oil Co. No. 17 Hubbard, 990 ft. W line, 1,650 ft. N line, W½ Sur. 72. Sand 2,745-51 ft.; testing.

Highland Oil Co. No. 18 Hubbard, 330 ft. W line, 990 ft. S line, Sur. 72. T.D. 2,755 ft.; comp.; 10 B.P.H.

Highland Oil Co. No. 20 Hubbard, 990 ft. W line, 1,650 ft. N line, Sur. 72. T.D. 2,708 ft.; comp.; 300 B.P.D.

Highland Oil Co. No. 27 Hubbard, Sur. 72. Set csg. 2,717 ft.; W.O.C.

Highland Oil Co. No. 6-D Hahl, sec. 63. Sand 2,576-87 ft.; W.O.C.

Humble O. & R. Co. No. 8-A Hubbard, Sur. 34. T.D. 2,546 ft.; drlg. plugs.

Humble O. & R. Co. No. 8-B Hubbard, W½ Sur. 33. T.D.; sand 2,675 ft.; drlg. plugs.

Humble O. & R. Co. No. 33-B Hubbard, 330 ft. N and E lines, Sur. 72. T.D. 2,756 ft.; comp.; 42.66 B.P.H.

Humble O. & R. Co. No. 34-B Hubbard, Sur. 72. R.U.

Humble O. & R. Co. No. 10 Ruiz, 2,419.5 ft. S line, 990 ft. W line Sur. 553. Set csg. 2,791 ft.; W.O.C.

Kaffie Lbr. Co. No. 1 M. H. Davidson, Sur. 114. Drlg. 1,026 ft.

Abbreviations Used in Drilling Reports

Abd.—Abandoned. B.R.—Building rig. B.S.—Basic sediment. C.O.—Cleaning out. Comp.—Completed. Csg.—Casing. Drlg.—Drilling. D.&A.—Dry and abandoned. Fshg.—Fishing. H.F.W.—Hole full of water. M.I.M.—Moving in materials. M.I.R.T.—Moving in rotary tools. O.I.H.—Oil in the hole. O.W.D.D.—Old well drilling (or drilled) deeper. O.T.D.—Old total depth. P.B.—Plugged (or plugging) back. R.O.G.—Rig on ground. R.U.—Rigging up. R.U.R.—Rigging up rotary. S.D.—Shut down. S.O.—Showing of oil. S.W.—Salt water. T.D.—Total depth. U.R.—Underreaming. W.O.C.—Waiting on cement to set.

Magnolia Pet. Co. No. 3 Hahl, 1,650 ft. N line, 330 ft. W line, Sur. 37. Rigging up.

Magnolia Pet. Co. No. 17 Hahl, 2,457 ft. W line, 330 ft. S line, Sur. 67. Sand 2,-690-91 ft.; W.O.C.

Magnolia Pet. Co. No. 22 Hahl, Sur. 67. Sand 2,597-98 ft.; W.O.C.

Montour Prod. Co. No. 6 Hubbard, 330 ft. S and E lines, NE¼ Sur. 75. Sand 2,645-54 ft.; comp.; no gauge.

Montour Prod Co. No. 7 Hubbard, 1,650 ft. E line, 330 ft. N line, S½ NE¼, Sur. 75. R.U.

Hiram Reed and J. T. Stover No. 1 C. W. Duke, 330 ft. N and E lines, SE¼ SE¼ Sur. 64. Spudding in.

Reynosa Oil Co. No. 2-A Davidson, NE¼, Sur. 114. Drlg. 2,207 ft.

Reynosa Oil Co. No. 3-A McLean, 330 ft. E line, 990 ft. S line, Sur. 62. Comp.; 10 B.P.H.; T.D. 2,557 ft.

Rosan Oil Co. No. 10 Hubbard 990 ft. S line, 1,650 ft. W line, Sur. 84. Drlg. 521 ft.

Rosan Oil Co. No. 9 Hubbard, 990 ft. S and W lines, Sur. 84. Sand 2,798-2,816 ft.; comp. 51 B.P.H.

Russ Pet. Co. No. 1 Hahl, 330 ft. S & E lines, SW¼, Sur. 63. Sand 2,576-84 ft.; comp. 355 B.P.D. on ½-in. choke.

Russ Pet. Co. No. 7-D Hahl, 330 ft. E line, 990 ft. S line, NE¼ Sur. 63. Testing 2,552-67 ft.

Shell Pet. Corp. No. 4 Hahl, 990 ft. E line, 330 ft. N line lease, Sur. 74. Comp. 3 B.P.H.; open tbng.; T.D. 2,568 ft.

Shell Pet. Corp. No. 1 Mendoza, 330 ft. S and W lines, Sur. 48. Drlg. 48 ft.

Sun Oil Co. No. 2 Hubbard, Sur. 84. Coring 2,800 ft.

Texas Co. No. 12 B.C.C., 990 ft. E line, 330 ft. S line, N½ sec. 59. R.U.

Texas Co. No. 23 Wendt, Sur. 68. Comp. 48 B.P.H. on ¾-in. ck.; T.D. 2,718 ft.

Texas Co. No. 24 Vela, Sur. 42. Sand 2,644-57 ft.; running liner.

Texas Co. No. 32 Vela, Sur. 42. R.U.

Texas Co. No. 20 Wendt, 330 ft. N line, 2,080 ft. W line, Sur. 68. Drlg. 1,150 ft.

Valley Osage Oil Co. No. 2 Hubbard, 990 ft. W line, 330 ft. N line, Sur. 75. Testing 2,614 ft.

Valley Osage Oil Co. No. 8 Hubbard, 330 ft. W line, 990 ft. N line, Sur. 75. R.U.

Valley Osage Oil Co. No. 2 Moody, 990 ft. S and E lines, 20-ac. tract, Sur. 60. T.D. 2,550 ft.; comp.; gasser.

Piedra Lumbre—Duval County

Magnolia Pet. Co. No. 1 D.C.R.C., 2,310 ft. W line, 330 ft. N line, Sur. 95. Sand 1,954-58 ft.; W.O.C.

Texas Co. No. 14 D.C.R.C., SW¼ Sur. 100. Drlg. 1,517 ft.

Seven Sisters—Duval County

Atlantic Oil Prod. Co. No. 5-C Welder, 330 ft. N and W lines, Sur. 591. Sand 2,462-91 ft.; comp. 23 B.P.H.

Atlantic Oil Prod. Co. No. 6-C Welder, 120-ac. tr., Sur. 591. Comp. 24 B.P.H.; sand 2,481-2,501 ft.

Atlantic Oil Prod. Co. No. 1-D Welder, 330 ft. N and E lines, Sur. 113. Set csg. 2,513 ft.; W.O.C.

Atlantic Oil Prod. Co. No. 1-E Welder, Sur. 381. Drlg. 690 ft.

Buchanan & Blanco Oil Co. No. 10 Welder, 330 ft. W line, 615 ft. S line, E½ SW¼ Sur. 385. Flowing in pits; no gauge; T.D. 2,566 ft.

Buchanan & Blanco Oil Co. No. 11 Welder, 330 ft. E line, 915 ft. S line, E½ SW¼ Sur. 385. Drlg. 1,140 ft.

Diamond Half Oil Co. No. 2 Serna, 330 ft. N line, 1,516 ft. W line, N½ NE¼ Sur. 384. Sand 2,211-16 ft.; drlg. plugs.

Humble O. & R. Co. No. 5-B Serna, 990 ft. S line, 330 ft. E line, Sur. 384. Swbng.; T.D. 2,209 ft.

Humble O. & R. Co. No. 6-A Serna, SW¼ Sur. 384. Sand 2,447-55 ft.; comp. 11.25 B.P.H. on ⅝-in. ck.; T.D. 2,462 ft.

Humble O. & R. Co. No. 7-A Serna, 330 ft. S and W lines, SW¼, Sur. 384. Comp. 34 B.P.H.; T.D. 2,475 ft.

Humble O. & R. Co. No. 8-A Serna, SW¼ Sur. 384. Drlg. 2,067 ft.

Humble O. & R. Co. No. 2 Wright, SW¼ Sur. 118. T.D. 2,528 ft.; reaming 2,515 ft.

Mid-Continent Pet. Corp. No. 7 Serna, S½ N½ Sur. 384. M.I.M.

Parr Oil Co. No. 1 Welder, 3,630 ft. E line, 330 ft. N line, Sur. 385. Sand 2,-431-44 ft.; set csg.; W.O.C.

Reliance Oil Co. & Kleiner No. 2 Welder, 1,665 ft. E line, 330 ft. S line, S½, Sur. 381. Drlg. 1,921 ft.

Santa Clara Oil Co. (Atkins & O'Neil) No. 1-B Welder, 330 ft. N and W of SE cor. Sur. 383. M.I.M.

Santa Clara Oil Co. (Atkins & O'Neil) No. 16 Welder, 330 ft. S and W lines, NE¼ Sur. 385. Drlg. 1,617 ft.

Santa Clara Oil Co. and H. H. Henderson No. 9-C Welder, 2,970 ft. E line, 1,650 ft. S line, Sur. 381. Set csg. on sand; W.O.C.

Santa Clara Oil Co. No. 12 Welder, 330 ft. W line, 990 ft. S line, NW¼, Sur. 385. Comp.; no gauge; sand 2,464-87 ft.

Santa Clara Oil Co. No. 25 Welder, NE 160-ac. tr., Sur. 383. T.D. 1,975 ft.; T.A.

Santa Clara Oil Co. & H. H. Henderson No. 9-C Welder, 2,310 ft. E line, 1,650 ft. S line, Sur. 381. M.I.M.

Shell Pet. Corp. No. 4 Welder, 330 ft. S and E lines, W½ SW¼ Sur. 385. Comp. 35 B.P.H. on ½-in. ck.; T.D. 2,492 ft.

Shell Pet Corp. No. 2-B Welder, 330 ft. W line, 990 ft. W line, E½ SE¼ Sur. 385. Drlg. 2,165 ft.

Shell Pet. Corp. No. 5 Welder, 330 ft. S and W lines, Sur. 385. M.I.M.

Westheimer & Daube No. 5 Z. Campos, 1,-650 ft. S line, 330 ft. W line, Sur. 224. T.D. 1,740 ft.; S.D. for wtr.

Pearsall—Frio County

Amerada Pet. Corp. No. 1 Correy & McWilliams, 660 ft. N line, 721 ft. W line, Tr. 17, Manuel Tijerina Sur. No. 300. Drlg. 4,034 ft.

Amerada Pet. Corp. No. 1 Correy & McWilliams, 1,980 ft. S line, 746 ft. W line, Tr. 3, Jose Arocha Sur. No. 299. Drlg. 3,720 ft.

Amerada Pet. Corp. No. 1 Correy & McWilliams, 660 ft. S line, 728 ft. E line, Tr. 6, Jose Arocha Sur. No. 298. Spudded in.

Amerada Pet. Co. No. 5 Halff & Oppenheimer, 990 ft. N No. 1 Michail, Sim-Glenn Sur. No. 335. T.D. 5,465 ft.; comp. 860 B.P.D.

Amerada Pet. Corp. No. 7 Halff & Oppenheimer, 1,320 ft. W line, 330 ft. S line, J. H. Gibson Sur. No. 16. M.I.M.

Amerada Pet. Corp. No. 1 Kothman, 500 ft. N and W lines, B. L. Crouch Sur. No. 90/6. R.U.

T. Davis No. 1 Halff & Oppenheimer, 339-ac. tract, J. D. Clare Sur. 366⅓. Sand 4,022-33 ft.; flowed oil and S.W.; T.D. 4,400 ft.; S.D.

Gillette—Goliad County

Jane Oil Co. No. 1 Lackey & Welder, 590 ft. SW No. 1 Gillette, J. Gomez Sur. R.U.

Jane Oil Co. No. 4 Mudd, 1,650 ft. SW line, 990 ft. NW line lease. T.D. 3,689 ft.; comp. 3 B.P.H. on ¼-in. choke.

Magnolia Pet. Co. No. 1 Porter, 512 ft. NE line, 330 ft. SE line, 142-ac. tract, Myers Sur. No. 26. Drlg. 3,732 ft.

Mercedes—Hidalgo County

Union Sulphur Co. No. 7 American Rio Grande L. & I. Co., 4,000 ft. SE of No. 1 Farm tr. 2,209, Blk. 59. Cleaning; T.D. 7,598 ft.

Union Sulphur Co. No. 8 American Rio Grande L. & I. Co., 640 ft. N & E lines Tr. 2,120, Blk. 87. Coring shale 7,330 ft.

Samfordyce—Hidalgo County

J. H. Anderson No. 2 Guerra, Tr. 254, Porc. 40. Testing sand 2,748-54 ft.

J. T. Barlow No. 1 Marta Flores de Chapa, 230 ft. W line, 692 ft. S line, Tr. 250, Porc. 39. S.D. 690 ft.

Dean Bros. No. 1 Lula George, 150 ft. S line, 330 ft. W line, 10-ac. tract, Tract 13, Porc. 40. R.U.

Ralph E. Fair No. 1-B Seabury, Tr. 256, Porc. 38. Drlg. 2,457 ft.

Weekly Oil Co. No. 1 F. B. Guerra, 330 ft. E line, 150 ft. S line, 9-ac. tract, Tract 12, Por. 41. T.D. 3,100 ft.; S.D.

San Diego—Jim Wells County

Houston Oil Co. No. 1 Hawkins & Wallace, 990 ft. S and E lines, Blk. 11. Drlg. 5,321 ft.

Lucas—Live Oak County

Houston Oil Co. No. 33 Cartwright, 1,172 ft. N of No. 21, R. R. Botallio grant. Blowing wild and burning.

Cailham—McMullen County

Chas. Hall No. 3 Claunch, 460 ft. SE No. 1, Hely Sur. T.D. 930 ft.; S.D.

Luray Oil Co. No. 9 Glass, 160 ft. S Frio River, 520 ft. E line, Blk. 14, Hely Sur. T.D. 720 ft.; fishing.

Luray Oil Co. No. 10 Stitz, Blk. 46, Garner Sur. T.D. 1,625 ft.; comp. 15 B.P.D.

Jacob—McMullen County

Loma Oil Co. No. 105-A Jacob, 220 ft. E line tract, 660 ft. N No. 1-F Jacob. Drlg. 180 ft.

National Pet. Co. No. 2-C Lark, 150 ft. N and E lines, Blk. 125, Scrugham Sur. T.D. 956 ft.; comp.; shut in.

Baldwin—Nueces County

Magnolia Pet. Co. No. 10 Baldwin, 466 ft. N and W line, tract, A. F. Martin Sur. No. 150. Drlg. 2,550 ft.

Saxet Heights—Nueces County

Circle Oil Co. No. 1 Whelan, 330 ft. S and E lines tr., Villareal Sur. Sand 4,-058-78 ft.; comp.; no gauge.

Conroe Drlg. Co. No. 3 Robinson, 330 ft. S and E lines, Blk. E, McBride Part. Set sur. csg. 511 ft.; W.O.C.

J. K. Culton No. 4 Baldwin, 117 ft. E line, 330 ft. N line, Blk. 20, Villareal Sur. Sand 4,080-90 ft.; 730 B.P.D.; ¼-in. ck.

Culton & Republic Nat. Gas Co. No. 1-C Baldwin, 330 ft. N and W lines, Blk. 13. Testing 4,083-90 ft.

Tom Graham No. 1 City of Corpus Christi, C 5-ac. tr., Villareal Sur. Drlg. 230 ft.

Tom Graham No. 1 Whelan, 330 ft. N and E lines, 40-ac. tract, Villareal Sur. Drlg. 4,300 ft.

D. H. Hawn No. 1 Skipper, cen. 9-ac. tr., N of No. 1 Shely. Drlg. 3,870 ft.

Hiram Reed No. 1 Scheffield & Hutchins, C 2-ac. tr. Comp. 20 B.P.H.; T.D. 4,-084 ft.

Marine Oil Co. No. 1 Kaler, 250 ft. N line, 150 ft. W line, 13.05-ac. tract, Villareal Sur. Set sur. csg.; W.O.C.

Marine Oil Co. No. 2 Chas. B. Kaler, Villareal Sur. Comp.; no gauge; T.D. 4,080 ft.

Marine Oil Co. No. 1 Worley, 14.51-ac. tr., Villareal Sur. T.D. 4,082 ft.; drlg. plugs.

Republic Nat. Gas Co. No. 1-B Baldwin, 330 ft. N and W lines, Blk. 19. T.D. 4,-070 ft.; cleaning.

Republic Nat. Gas Co. No. 2-B Baldwin, 44-ac. tract, Villareal Sur. Drlg. 3,340 ft.

Southern Minerals Corp. No. 1 Alkali, 330 ft. S line, 243 ft. E line, Southern Alkali Corp. site. Coring 3,080 ft.

Southern Minerals Corp. No. 2 Chas. Kaler, Villareal Sur. Drlg.

Taylor Ref. Co. No. 1 J. Dunn, Villareal Sur. Sand 4,036-44 ft.; comp. 5 B.P.H.

Westgate Oil Co. No. 1 Carver, cen. Tract No. 3, Ellendale Gardens. Spudding in.

Westgate Oil Co. No. 1 Flood, cen. Blk. 4, Ellendale Gardens. Drlg.

Westgate Oil Co. No. 1 Geistman, 20-ac. tr., Villareal Sur. Drlg.

Westgate Oil Co. No. 1 Sturm, 143.7 ft. W line, 1,777.8 ft. NW line, 89-ac. tract. Drlg. 3,814 ft.

Saxet—Nueces County

Benson & Cargray No. 1 Bertha Buckholt, cen. 9-ac. tract, C. Land Sur. No. 404. T.D. 4,420 ft.; Comp. 200 B.P.D.

R. B. Bryan No. 1 Clarkwood Townsite, 105 ft. S line, 190 ft. W line tract, Blk. 14, Land Sur. 404. M.I.M.

R. B. Bryan No. 1 Isensee, 354 ft. N line, 174 ft. E line tr., Land Sur. 404. R.U.

Capitol Oil Co. No. 1 Clarkwood, 130 ft. N and E lines, Blk. 2, Clarkwood Townsite. M.I.M.

Houston Oil Co. No. 3 Harrell, 330 ft. S and E line, Blk. 19, Farm Lots 576. Set surface csg.; W.O.C.

Houston Oil Co. No. 9 Rand Morgan, 330 ft. W line, 1,025 ft. N line, sec. 7, Rincon del Oso Sur. Recmtng. 4,867 ft.

Maryland O. & G. Co. No. 1 Winship, cen. Lot 3. Drlg. shale 2,506 ft.

Morgan-Texas Oil Co. No. 1 Morgan, 990 ft. E line, 330 ft. N line, Sur. 403. Set surface csg.; W.O.C.

Renwar Oil Co. No. 1 Winship, Blk. 3, Clarkewood Townsite, C. Land Sur. T.D. 4,348 ft.; comp. 9 B.P.H.

Republic Nat. Gas Co. No. 1-B Baldwin, 660 ft. S No. 3, 44-ac. tr. Drlg. 1,257 ft.

W. A. Richardson No. 1 Meredith, Blk. 4. Set csg. 4,408-18 ft.; W.O.C.

W. A. Richardson No. 1 Smith, C Blk. 4, Clarkwood townsite. R.U.

Shell Pet. Corp. No. 2 Flato, 355 ft. N line, 330 ft. E line, Blk. 3. Setting csg. 4,-861 ft.

Southern Mineral Corp. No. 2 Smith, Blk. 4, Sheppard Farm Lots. Sand 4,851-57 ft.; running screen and liner.

Texon Royalty Co No. 1 T. H. Isensee, sec. 404. Drlg. 3,972 ft.

Texon Royalty Co. No. 2 Kocurek, lease 156.53-ac. tract J. R. Ward Survey No. 316. Drlg. 513 ft.

Plymouth—San Patricio County

Magnolia Pet. Co. No. 6 Corpus Christi Land Bank, 250 ft. E line lease, 933 ft. S.W. No. 5, Hunter Sur. Drlg. 4,521 ft.

Plymouth Oil Co. No. 33 C. Welder, 7,925 ft. S line, 716.5 ft. E line, sec. 71. Comp. 200 B.P.D.; T.D. 5,621 ft.

Plymouth Oil Co. No. 34-C Welder, 2,825 ft. N line, 1,116 ft. E line, sec. 49. Sand 5,636-42 ft.; flowing in pits.

Plymouth Oil Co. No. 35-C Welder, 457.5 ft. S line, 2,702.9 ft. E line, sec. 71. T.D. 5,643 ft.; swbng.

Plymouth Oil Co. No. 36-C Welder, 2,599 ft. W line, 1,372 ft. N line, sec. 49. T.D. 5,504 ft.; drlg. plugs.

Plymouth Oil Co. No. 37-C Welder, 3,305 ft. E line, 670 ft. N line, sec. 49. Set csg. 5,502 ft.; W.O.C.

Plymouth Oil Co. No. 38-C Welder, 2,978 ft. S line, 2,395 ft. W line, sec. 49. R.U.

Sun Oil Co. No. 6 Hunt, 1,320 ft. S of No. 3, 446 ft. E line, sec. 34. Set csg. 5,634 ft.; W.O.C.

Taft Field—San Patricio County

Humble O. & R. Co. No. 1 Mayo, 330 ft. S and E lines, lease, Wm. Burns Sur. D.S. test 2,961-65 ft.; 2,000-ft. oil sand; W.P. 25 lbs., 15 min.; comp. 25 B.P.H. on ¾-in. choke; T.D. 3,975 ft.

Shell Pet. Corp. No. 1 Pullin, Blk. 4, sec. 1. M.I.M.

Rio Grande City—Starr County

Fech Oil Co. No. 5 Frank Doyno, 150 ft. N line, 522 ft. W line, Blk. 4, Tract 77-A, Porc. 61. Sand 1,446-53 ft.; comp.; no gauge.

Samfordyce—Starr County

Phillips and Barnsdall No. 7 Yturria Land & Cattle Co., 110-ac. lease, E½ Porc. 100. Sand 2,801-08.5 ft.; comp. 40 B.P.H. on ¼-in. choke.
Phillips Pet. Co. No. 3 Garcia L. & C. Co., W½ Porc. 100. Fshg. drill collar 1,690 ft.
Sun Oil Co. No. 1 Chapotal, 330 ft. E line, 304 ft. N line, Porter tract, Porcion 99. Sand 2,514-16 ft.; set csg.; W.O.C.

Carolina-Texas—Webb County

Foster Barnsby No. 5 Webster, Sur. 684. Coring 3,045 ft.

Cole—Webb County

Cole Pet. Co. No. 94 Rosa Benavides, 330 ft. NW and SW lines, Blk 2 Sur. 13. Comp. 150 B.P.D.; T.D. 2,953 ft.
Cole Pet. Co. No. 95 Rosa Benavides, Blk. 7, Sur. 7. Drlg. 320 ft.

Lopez—Webb County

Hunter Oil Co. No. 3 Billings, 330 ft. S and W lines, SE¼ NE¼ Sur. 113. Comp. 5 B.P.H.; T.D. 2,180 ft.
Mills Bennett Prod. Co. No. 7 Billings, 330 ft. N and W lines. NE¼ SE¼ Sur. 113. Comp. 15 B.P.H.; T.D. 2,173 ft.
Mills Bennett Prod. Co. No. 8 Billings, 330 ft. E line, 2,310 ft. S line, Sur. 113. Set sur. csg.; W.O.C.
Mills Bennett Prod. Co. No. 3 Montemayor, 2,310 ft. W line, 2,042 ft. N line, Sur. 114. Drlg. 1,832 ft.
Mills Bennett Prod. Co. No. 2 Valdez, 990 ft. W line, 1,308 ft. N line, Sur. 111. Comp.; 20 B.P.H.; ¼-in. choke; sand 2,210-19 ft.
Mills Bennett Prod. Co. No. 3 Valdez, 1,-650 ft. W line, 1,308 ft. N line, Sur. 111. Drlg. 230 ft.
Luling O. & G. Co. No. 1 Peal, 330 ft. S and E lines, Blk 11, Sur. 72. M.I.R.
Montour Prod. Co. No. 3-A Lopez, 330 ft. W line, 1,993 ft. N line, Sur. 111. Sand 2,222-28 ft.; comp.; no gauge.
Montour Prod. Co. No. 4-A Lopez, 330 ft. W line, 1,897 ft. N line, Sur. 111. Drlg. 1,725 ft.
G. G. Mortimer No. 1 Garcia Community Tract, 288 ft. W line, 330 ft. N line, 13-ac. tract, Sur. 114. Comp. 16 B.P.H.; T.D. 2,161 ft.
G. G. Mortimer No. 4 Alonzo Lopez, 330 ft. N and E lines lease, Sur. 112. Comp. 16 B.P.H.; T.D. 2,228 ft.
G. G. Mortimer No. 8 M. Lopez, Sur. 112. Drlg. 320 ft.
Superior Oil Co. No. 6 Phillips, 2,310 ft. E line, 660 ft. N line, Sur. 109. Comp. 20 B.P.H.; T.D. 2,243 ft.
Superior Oil Co. No. 7 Billings, 2,970 ft. E line, 330 ft. N line, Sur. 109. Drlg. 750 ft.

O'Hern—Webb County

Magnolia Pet. Co. No. 35 Brennan-Benavides, Hale Subd. W.O.C. 2,712-28 ft.
Magnolia Pet. Co. No. 5 Servando Benavides, Blk. 392. Sand 2,789-90.5 ft.; W.O.C.
T. S. Reid No. 1 Benavides, Blk. 319. R.U.
Texas Co. No. 13 Benavides, Blk. 393. Sidetracking 2,723 ft.
Texla Oil Co. No. 3-B Benavides, Hale Subd., Arispe grant. Drlg. 2,723 ft.

Escobas—Zapata County

B. W. Roscoe No. 4 Bustamante, Share 33. R.U.
Texas Co. No. 35 Whitehead, 25,303 ft. SW line, 11,343 ft. SE line, Cerrito Blanco grant. T.D. 1,263 ft.; D.&A.

Haynes—Zapata County

Clover O. & G. Co. No. 9 Haynes, 1,400 ft. SW line, 1,035 ft. NW line, Blk. 7. Comp. 25 B.P.D. on pump; sand 915-21 ft.
Clover O. & G. Co. No. 10 Haynes, Blk. 7. Drlg. 188 ft.
South Texas Oil Co. No. 1 fee, 330 ft. N and W lines, Blk. 21, Sur. 768. Coring 1,747 ft.

NORTH CENTRAL TEXAS WILDCATS

Week Ending March 14

Archer County

B. L. Albicht No. 1 E. Colgan, 1,650 ft. W and 1,700 ft. N, T.E.&L. Sur. No. 2,488. Spudding.
L. T. Burns No. 1 J. J. Perkins-B, 1,086 ft. S and 783 ft. E, T.E.&L. Sur. No. 1,-888. Rig.
Deep Oil Dev. Co. No. 11, Lease 4, L. F. Wilson, sec. 76, A.T.N.C. Lands. C.O. after shot; est. 120 bbls.
Luther Hedrick et al No. 1 M. B. Ray, Blk. 3, Harris Subd. R.U.

Baylor County

Consolidated Oil Co. No. 1 Portwood "Y," 600 ft. N and 150 ft. W, SE cor. NE¼ T.E.&L. Sur. No. 3,128. Drlg. 1,417 ft.
Hardgrave & McCulloch No. 1 Louis Hrncirik, sec. 5, B.B.B.&C. Sur. A-70. Shut down 300 ft.
Hunter & Everts No. 1 J. H. Hampton, 1,700 ft. S and E, NW cor. T.E.&L. Sur. No. 2,461. Drlg. 1,360 ft.
Morris & Spoonts No. 1 D. K. Martin, sec. 212, T.&N.O. Sur. A-745. Drlg. 940 ft.
Morris & Spoonts No. 1 J. M. Parker, 660 ft. S and 990 ft. W, NE cor. B.B.B.&C. Sur., sec. 148, Blk. A. Spudded and S.D.
W. P. Morris et al No. 1 C. T. Porter, Edward Brown Sur. Sand with S.O. and gas 1,320-24 ft.; T.D. 1,333 ft.; fshg.

Cooke County

Anderson & Kerr No. 1 F. A. Bruthmeyer, 999 ft. N and 491 ft. W, SE cor. 120-ac., H. Stroud Sur. A-930. Coring 1,880-85 ft.; S.S.O.
Cain & Chandler No. 1 J. B. Burch, J. McWilliams Sur. A-658. Material.
Hardin Oil Co. No. 1 J. G. Bonner, J. Lindheimer Sur. Coring 1,860 ft.
J. F. Hart No. 1 Gwyn, University Sur A-619. Drlg. 1,872 ft.
H. E. Hoover et al No. 1 G. C. Cartwright, B. J. Thompson Sur. A-1,008. Drlg. 1,-300 ft.
Kingery Bros. No. 1 S. D. Meador, G. W. Long Sur. A-570. Drlg. 807 ft.
Lanier et al No. 1 Thetford, S.P.R.R. Sur. A-967. Drlg. 810 ft.
L. A. Long et al No. 1 Sarles, Hunt County School Lands Sur. A-440. Drlg. 1,-620 ft.
Hank Masterson No. 1 R. J. Timms, J. W. McPherson Sur. A-696, 1,500 ft. S and 150 ft. W, NE cor. farm. R.U.R.
Mills & Carey No. 1 A. M. Bezner, J. B. Trenary Sur. Fshg. at 670 ft.
Mullin et al No. 1 Spares, 2,100 ft. E, 300 ft. N, SW cor. B. P. Tishler Sur., A-1053. Rig up.
N. Newburn No. 1 Dotson, Wm. Campbell Sur. A-238. S.D. 1,520 ft.
Charles Newsom No. 1 T. Wiesman, Blk. 9, Thos. Scott Sur. A-900. S.D. 1,200 ft.
Petroleum Producers No. 1 J. W. Mount, J. C. Meeks Sur. A-758. Drlg. 1,085 ft.
L. E. Rader No. 1 McCubbin, R. Wheelock Sur. A-1,684. Drlg. 945 ft.
Raye Oil Corp. No. 1 Reiter, G. M. Casey Sur. A-198. Sand with S.O. 936-43 ft. and 944-45 ft. T.D. 986 ft.; waiting for spudder.
W. F. Russell No. 1 Belle Payne, Marshall University Sur. A-620. Spudded and S.D.
J. M. Russell et al No. 1 B. B. Bawley, Blk. 24, John Barnett Sur. Drlg. 640 ft.
Ruwaldt-Couch No. 1 Sarah Goff, 1,770 ft. W and 1,670 ft. S, NE cor. W 80 acres Goff land, S.P.R.R. Sur. A-982. Drlg. 1,-320 ft.
Sunray Oil Co. et al No. 1-A A. C. McCall, W. H. White Sur. A-1,134. Drlg. 2,-505 ft.
B. F. Thompson No. 1 F. Trubenback, P. Davidson Sur. A-337. Drlg. 100 ft.
Whitehead et al No. 1 W. Reed, 150 ft. S and E, NW, F. Earthman Sur., A-349. R.U. standard tools.
Woodbine Oil Co. No. 1 Potter & Potter, J. Gorham Sur. Drlg. 805 ft.

Denton County

Jack Caudle et al No. 1 B. D. Jones, 400 ft. from N and 200 ft. from W lines of most northerly NW cor. of farm, John Morton Sur. Spudded.
Oil Finance Corp. No. 1 J. S. Gambill, T. Burress Sur. Drlg. 810 ft.
C. S. Head No. 1 Travelers Insurance Co., Wm. A. Thompson Sur. A-1,238. Spudding 200 ft.

Foard County

Humble O. & R. Co. No. 1 Burnett, sec. 16, Blk. X, S.P.R.R. Sur. Drlg. 2,250 ft.

Jack County

Bryson Oil & Gas Co. No. 1 G. E. Evett, Geo. Hardesty Sur. A-294. Drlg. 2,300 ft.
J. W. Cole et al No. 1 Mrs. D. C. Clayton, 1,650 ft. from S and 330 ft. from E lines of farm, Lewis Knight Sur. A-324. Rig.
R. M. Gillespie No. 1 B. F. Rankin, 330 ft. from S and 581 ft. from W lines of farm, Jacob Ash Sur. A-8. Drlg. 2,437 ft.
C. Kadane No. 1 E. F. Smith, 940 ft. E and 380 ft. N, SW cor. S.P.R.R. Sur. A-552. Spudding.
E. C. Lawson et al No. 1 Patterson, Lewis Knight Sur. A-324. Drlg. 2,485 ft.
Nelson Oil Synd. No. 1 J. P. McCoy, A. S Ensworth Sur. Drlg. 2,710 ft.
Ray & Staniforth No. 1 L. J. Hestor, 660 ft. N and 330 ft. W, SE cor. farm in J. Ash Sur. A-8. R.U.R.

Montague County

A. Gutowsky et al No. 1 J. E. Lemmon, Blk. 13, C. K. Hamm Sur. A-322. S.D. 685 ft.
J. F. Hart No. 1 W. M. Talley, J. Perrin Sur. Drlg. 1,651 ft.
L. C. Heydrick No. 1 J. B. Lawrence, 2,-640 ft. E and 150 ft. N, Lawrence 160-ac. tr. in M. Burnside Sur. A-14. Drlg.
Jim Seeds et al No. 1 Coombs, sec. 64, M.E.P.&P. Sur. S.D. 1,255 ft.
J. M. Holmes No. 1 H. D. Field, 150 ft. E and 450 ft. N, SW cor. 155 acres, sec. 55, M.E.P.&P. Sur. A-528. Drlg. 1,700 ft.
M. C. Wells No. 1 Collier, M. Hunt Sur., sec. 14. T.A.

Throckmorton County

Ben Ashe et al No. 1 W. B. Parrott, sec. 961, T.E.&L. Sur. Loc.
Alex M. Snyder No. 1 W. J. Timmons, 500 ft. from S and 1,233 ft. from W lines of sec. 793, T.E.&L. Sur. Material.

Wichita County

Clark et al No. 1 S. P. Gibson, 450 ft. S and 150 ft. W, NE cor. NW¼, sec. 302. W.C.S. Drk.
F. P. Cullum No. 1 T. L. Burnett, 1,470 ft. N and 1,170 ft. W, SE cor. sec. 4, H.T.&B. Sur. A-753. Drlg. 900 ft.
T. F. Hunter No. 1 S. P. Gibson, sec. 301, W.C.S., 1,170 ft. S and W, NE sec. Loc.

Wilbarger County

Franklin Oil Co. No. 1 D. G. Feller et al, sec. 108, Blk. 14, H.&T.C. Sur. S.D. 1,570 ft.
W. B. Hamilton No. 1 W. T. Waggoner estate, Blk. 30, J. Poitevent Sur. A-1,612 Drlg. 2,064 ft.
Lane & Simons No. 1 Allison, sec. 43, H. &T.C. Sur., Blk. 12, 1,500 ft. N and 5,-280 ft. E, SW cor. farm. Spudding.
Ed S. Smith et al No. 1 W. T. Waggoner, 1,170 ft. S and 150 ft. W ,NE cor. sec. 50, Blk. 14, H.&T.C. Sur. Drlg. 1,620 ft.
Smith No. 1 S. A. Dill et al, sec. 32, Blk. 14, H.&T.C. Sur. S.D. 2,090 ft.
Wheeler et al No. 1 W. T. Waggoner, 150 ft. N and E, SW cor. 80 acres, sec. 99, H.&T.C. Sur., Blk. 14. Drlg. 200 ft.

Young County

Carl Pet. Co. No. 1 Goss, sec. 1,592, T.E. &L. Sur. Drlg. 1,200 ft.
Christie Bros. No. 1 Primitive Baptist Church, S. L. Hill Sur. A-126. Drlg. 2,-810 ft.
Curtis & Bracken No. 1 Allar Co., H Garmes Sur. A-104. Running 10-in.; T.D. 2,460 ft.
Harry Hines et al No. 1 R. T. Kerr, sec. 173, T.E.&L. Sur. Drlg. 825 ft.
C. E. Knox No. 1 Washam, Blk. 8, sec. 1,412, T.E.&L. Sur. Drlg. 1,500 ft.
Dobbs Oil Co. and McLester No. 1 Lasquey, J. Busse Sur. A-1,570. Drlg. 2,-526 ft.
Murry R. Hart No. 1 McCluskey, T. J. Mullinax Sur. A-1,004. Drlg. 110 ft.
Nash & Windfohr No. 1 W. S. Simms, D Franklin Sur. A-1,425. Drlg. 1,300 ft.
C. D. Neff et al No. 1 W. A. Dennis, C. F. Bass Sur. Drlg. 500 ft.
Pitzer & West No. 1 McCluskey, sec. 1,184 T.E.&L. Sur. A-327. H.F.W.; U.R. 10-in. to 2,320 ft.
Pitzer & West No. 1 S. L. Thornton, sec. 1,015, T.E.&L. Sur. A-824. Drlg. 1,450 ft.
Rathke Oil Co. No. 2 J. T. Rogers, 330 ft. from S and 1,100 ft. from W lines of S. H. Graham Sur. A-124. Drlg. 980 ft.
Roberts Oil Corp. No. 1 Brogden, H Garmes Sur. A-104. Drlg. 2,990 ft.

WEST TEXAS WILDCATS

Week Ending March 14

Andrews County

Humble O. & R. Co. No. 1 J. M. Spinks, sec. 13, Blk. A-20. Rigged up rotary.
Tipplehorn No. 2 King, sec. 11, Blk. A-46. Drlg. 4,020 ft.

Brewster County

F. C. Dodson No. 1 Texas American Synd., sec. 66, Blk. 10, G.H.&S.A. Sur. Drlg. 706 ft.

Concho County

Maverick Oil Co. No. 1 Jim Rice, sec. 18, I.N.R. Ry. Sur. Drlg. 2,250 ft.
John W. Westbrook No. 1 Ledbetter, sec. 2, Sur. 1,673. Show gas 2,110 ft.; S.D. 2,112 ft. for csg.

Crane County

Big Basin Pet. Co. No. 1 Cowden. Fishing 2,359 ft.
Clark et al No. 1 A. P. Jordan, sec. 12, Blk. B-22, P.S.L. Sur. Location.
Humble O. & R. Co. No. 1 J. B. Tubb, sec. 11, Blk. B-27, P.S.L. Sur. T.D. 4,375 ft.; testing.
Moore Bros. No. 1 Barnsley, sec. 43, Blk. 32, P.S.L. Sur. Drlg. 1,560 ft.
Sinclair Prairie Oil Co. et al No. 1 Tubbs, 330 ft. from S and E, sec. 3, Blk. B-37, community test. Acidized with 10,000 gals. and pumped 7 bbls. oil; S.D. 3,164 ft.

Crockett County

J. G. Harris No. 1 Parker, sec. 83, Blk. 1, I.&G.N. Sur. S.D. 2,016 ft.
John I. Moore No. 1 A. C. Hoover, sec. 4, Blk. FF, B.&B. Sur. S.D. 360 ft.

Culberson County

Anderson-Prichard Oil Corp., Magnolia Pet. Co. et al No. 1 Borders, sec. 34, Blk. 69, P.S.L. Sur. Drlg. 4,975 ft.

Dawson County

Ray Albaugh et al No. 1 John Robinson, sec. 46, Blk. M, E.L.R.R. Sur. T.D. 4,862 ft.; underreaming casing.

Ector County

W. Dunning, Jr., No. 1 H. E. Cummins, 2,200 ft. from S and 440 ft. from E, sec. 33, Blk. 45, Twp. 1n, T.&P. Sur. R.U.
W. P. Dunning, Jr. et al No. 1 Mrs. Clarence Scharbauer, sec. 33, Blk. 44, Twp 1n, T.&P. Sur. T.D. 4,175 ft.; shot 120 qts. 4,145-75 ft.; flowed 150 bbls. day.
Stanolind O. & G. Co. No. 1 J. E. Witcher, sec. 24, Blk. 43, Twp. 2s, T.&P. Sur. T.D. 4,230 ft.; P.B. to 4,211 ft.; fishing.

Edwards County

Paul Teas No. 1 J. B. Stewart, sec. 2, Blk. DA, G.C.&S.F. Sur. Drlg. 2,600 ft.

Fisher County

Forest Dev. Co. No. 1 A. M. Dry, 640 ft. from S and 2,000 ft. from E, sec. 108, Blk. 2, H.&T.C. Sur. T.D. 2,170 ft.; to plug back to straighten hole.

Gaines County

Landreth Prod. Co. No. 1 Kirk, sec. 22, A-21. Drlg. 150 ft.
W. T. Walsh et al No. 1 Averitt, sec. 228, Blk. G, W.T.R.R. Sur. Elev. 3,322 ft.; gas show 2,785 ft.; increase 2,795 ft.; increase gas 3,132 ft.; drlg. 4,870 ft.

Garza County

M. L. Richards No. 1 Post Estate, sec. 6, Blk. 5, K. Aycock Sur. Drlg. 2,611 ft.

Glasscock County

Fleetboro Oil Corp. No. 1 F. C. Dodson, 330 ft. from S and E, sec. 13, Blk. 34, Twp. 3s. Drlg. 776 ft.

Hudspeth County

Haymon Krupp Oil & Land Co. No. 1 Thaxton, sec. 34, Blk. 74, Twp. 4, T.&P. Sur. S.D. 873 ft.

Jeff Davis County

C. M. Joiner No. 1 Jones & Coffield, sec. 8, Blk. 3, H.&T.C. Sur. Drlg. 2,778 ft.

Jones County

Hughes No. 1 Bumpass, T. Maltby Sur. No. 252. Drlg. 2,322 ft.
Bob Elmore No. 1 Coton, sec. 10, D.D.&A. lands, 3 miles W of Avoca. S.D. 1,640 ft.
Fain-McGaha Oil Corp. No. 1 Hayden, 200 ft. from N and 2,411 ft. from E, C. Martinez Sur. 195. Rigged up.
Humphrey's No. 1 A. A. McDuff, 200 ft. from S and 710 ft. from E, sec. 1, Blk. 15, T.&P. Sur. Fishing 1,342 ft.
Parker No. 1 C. L. Brown, 200 ft. from N and W of lease, sec. 9, Blk. 2, T.&N. O. Sur. Drlg. 522 ft.

Loving County

Mason Oil Co. No. 2 Mrs. M. Kyle, sec. 17, Blk. 55, Twp. 1. Location.

Martin County

Woodley Pet. Co. No. 1 M. S. King, sec. 30, Blk. 35, Twp. 3s, T.&P. Sur. T.D. 1,719 ft.

Menard County

Wilcox O. & G. Co. No. 1 Merchenson, sec. 158, E.L.R.R. Sur., Abst. 1,840, 8 miles S of Menard. Drlg. 937 ft.

Pecos County

Cardinal Oil Co. No. 1-I White & Baker, 990 ft. from N and 330 ft. from E, sec. 1, Blk. 194, G.C.&S.F. Sur. Drlg. 439 ft.
Trans-Pecos Oil Co. No. 1 F. W. Popham, sec. 235, Blk. 11, G.H.&S.A. Sur. Drlg. 300 ft.
Trans-Tex. Oil Co. No. 1 Caldwell, sec. 27, Blk. 40, Twp. 9, T.&P. Sur. S.O. 3,905-4,000 ft.; T.D. 5,280 ft.; P.B. 4,405 ft.; to acidize.
Trans-Pecos Oil Co. No. 1 Gallaher, 330 ft. from N and 2,310 ft. from W, sec. 9, Blk. 51, T.&P. Sur. Rigged up standard tools.

Presidio County

Linderman Bros. Oil Corp. No. 1 J. R. Bledsoe, sec. 15, Blk. 354, G.C.&S.F. Sur., 2½ miles N of Presidio. Drlg. 1,447 ft.

Schleicher County

Cardinal Oil Co. et al No. 1 J. A. Whitten, sec. 35, Blk. LL, T.C. Ry. Sur. T.D. 1,650 ft.; P.B. 650 ft.; straightening hole.
Magnus Oil Co. No. 1 Judkins & Spencer, C SW¼ sec. 4, Blk. V-28. Elev. 2,209 ft.; S.D. 4,407 ft.; show gas 4,350 ft.

Scurry County

Bristow & Cantrill No. 1 Shannon, Est., sec. 331, Blk. 97, H.&T.C. Sur. Drlg. 2,248 ft.
Coffield & Guthrie No. 1 Wade, 990 ft. from N and 330 ft. from W, sec. 115, Blk. 97, H.&T.C. Sur. T.D. 3,168 ft.; P.B. to 1,900 ft.; C.O.
G. W. Guthrie No. 1 Sorrells, sec. 101, Blk. 97, H.&T.C. Sur. Material.

Upton County

Cordova Union No. 1 fee, 672 ft. S of L.T.L.O. No. 1 Cordova Union, sec. 3, Blk. A.B. T.D. 2,176 ft.; P.B. 2,075 ft.; testing.
Greencliff Oil Corp. et al No. 1 J. H. Tippett, C NE¼ sec. 46, Blk. Y, T.C. Sur. Drlg. 2,806 ft.
L.T.L.O. and Foster No. 1 Cordova Union, 624 ft. W of Ray No. 1 Cordova Union, sec. 3, Blk. AB, A.E. Baxley Sur. T.D. 2,125 ft.; P.B. to 2,077 ft.; testing.
O. F. M. No. 1 King Ranch, sec. 32, Blk. 35, H.&T.C. Sur. S.D. 2,037 ft.

Ward County

Abell Brothers' No. 1 Lancaster Estate, sec. 61, Blk. 8, H.&G.N. Sur. in Pecos County, 5½ miles down Pecos River from NW cor. of Pecos and E cor. of Reeves County. Drlg. 1,626 ft.
California Co. No. 1 L. Adams, 990 ft. from SW and SE. sec. 39, blk. 34, H.&T.C. Sur. S.D. 816 ft.
C. Cothran No. 1 Greene, sec. 29, Blk. B-29, P.S.L. Sur. T.D. 2,360 ft.; shot; C.O.
Lindsay & Bolin No. 1 Thomas, 330 ft. from SW and SE, sec. 31, Blk. 34, H.&T.C. Sur. Drlg. 2,660 ft.
Olsen & Anderson No. 1 Yell, W. F. Stewart Sur., sec. 6. T.D. 2,600 ft.; P.B. to 2,455 ft.; standardizing.
Peck et al No. 1 Reynolds, 220 ft. from NW and 300 ft. from SW of W cor., sec. 12, Blk. 32, H.&T.C. Sur. Drlg. 1,013 ft.
Hal C. Peck No. 1 Monroe, 2,310 ft. from SW and SE. sec. 25, Blk. 5, H.&T.C. Sur. Material.
Superior Oil Co. No. 1 J. H. Hughes, 466 ft. from SE and SW, sec. 67, Blk. 34, H.&T.C. Sur. Derrick.

Winkler County

Gulf Prod. Co. No. 1 Hill, sec. 9, Blk. B-14. Drlg. 3,976 ft.
R. H. Henderson No. 1 McCutchen, sec. 16, Blk. B-3. Derrick.
R. H. Henderson et al No. 1 J. B. Walton, 330 ft. from S and 2,310 ft. from W, sec. 10, Blk. 26. Drlg. 1,111 ft.
R. H. Henderson et al No. 1 J. B. Walton, 330 ft. from N and E, sec. 9, Blk. 26. Drlg. 1,378 ft.
Herbert Oil Co. No. 1 I. Hendrick, 2,310 ft. from S and W, sec. 14, Blk. 26. Drlg. 2,445 ft.
Illinois Oil Co. No. 1 Central State Bank of Abilene, 330 ft. from S and E of SW¼ sec. 22, Blk. 26, P.S.L. Sur. Drk.
K-D Oil Co. No. 1 P. Mitchell, sec. 28, Blk. B-10, P.S.L. Sur. Drlg. 662 ft.
Magnolia Pet. Co. No. 1 N. R. Colby, sec. 38, Blk. 26, P.S.L. Sur. T.D. 2,991 ft.; to test.

PERSONAL

JACK H. CUDDY, Sinclair Prairie Oil Company, is the new president of the Petroleum Golf League of Tulsa, succeeding PAUL GRIFFIN, vice president of Oklahoma Pipe Line Company, president in 1935, the league's first season. ROY P. DORRIS, of the Texas Company, is vice president; L. M. LADET, of the Tulsa Tribune, secretary, and DAL DALRYMPLE, of The Oil and Gas Journal, treasurer. Ten Tulsa oil companies were represented at the organization meeting last week, and representatives of two more companies indicated they would enter teams for the 1936 competition. Mr. Cuddy was vice president last year.

ROY LUNDY, of the Tulsa Rig & Reel Company, Tulsa, recently visited various points in the New Mexico fields where his company has yards.

JOHN LEBOSQUET, independent oil operator of Wichita, Kans., was a business visitor in Tulsa the past week. He formerly was a scout for Stanolind Oil & Gas Company.

CARL C. ADDISON, formerly with the U. S. Geological Survey at Miami, Okla., has been added to the geological force of the Pure Oil Company at Fort Worth, Tex.

E. DE GOLYER, president of the Felmont Oil Company and widely known geologist, of Montclair, N. J., has purchased a house in Brookside Estates, Dallas, Tex., and will make his home in that city. MRS. DE GOLYER and daughters are spending the spring months in Bermuda.

J. EDGAR PEW, vice president of the Sun Oil Company, and MRS. PEW have sailed for South America.

WALLACE GORDON, Superior Oil Company geologist in California, is looking over Colorado oil possibilities for his company.

SIR JOHN CADMAN, chairman of the Anglo-Iranian Oil Company, has been reelected president of the Institute of Petroleum Technologists.

LESLIE M. CLARK of Denver, Colo., in the land department of Amerada Petroleum Corporation, has been transferred to Wichita, Kans. The company made an extensive survey in southern Wyoming and in Larimer County, Colo., and has been engaged in a big leasing campaign.

JAMES A. LEWIS, of Bradford, Pa., and MISS JOSEPHINE HERRICK, of Winfield, Kans., were married recently in the latter city. Mr. Lewis is a petroleum engineer with the Petroleum Reclamation Company in the Bradford field, and his bride was, until recently, a member of the musical faculty of Southwestern College in Winfield.

W. I. McCONNELL, treating engineer for Dowell, Inc., has been transferred from Tulsa to Midland, Tex.

GEORGE H. RAWLINS, of Chatham, Ontario, is making an inspection of the Michigan fields for Toronto interests.

F. COIL of Miami, Okla., has been transferred to the geological department of the Superior Oil Company at Midland, Tex.

W. M. HOLLAND, secretary-treasurer of the Maverick Oil Company, San Angelo, Tex., has just returned from a business trip to Toronto, Canada.

ALFRED HINDS, oil operator of Calgary, Alberta, visited Edmonton, recently in connection with proposed development work in the Athabaska district.

E. A. WAHLSTROM, division engineer for the Stanolind Oil & Gas Company, underwent a tonsilectomy at Cook Memorial Hospital at Fort Worth, Tex., on March 9.

J. O. HARPER, formerly in the gasoline department of the Houston Gas Company, at Houston, Tex., is now scouting for the Pure Oil Company out of Shreveport, La.

DON ALLEN, formerly with Empire Oil & Gas Company, is now doing microscopic work for Montana-Dakota Utility Company. He makes his headquarters at Baker, Mont.

R. H. HENDERSON of the Jeffers Oil Company is in charge of that company's operations in West Texas and New Mexico and has established headquarters in the Hogan Petroleum Building in Midland, Tex.

C. H. HOBBS, president of the Detroit Seamless Steel Tubing Company, Detroit, Mich., is making an extended business and pleasure trip to Texas, Mexico, and California, stopping over at Fort Worth to visit JON R. LONG, manufacturer.

Do You Remember?

From The Oil and Gas Journal Files

25 YEARS AGO

The Standard Oil Co. of California's recently created producing department will have its headquarters in Bakersfield, with Fred H. Hillman, general superintendent, in charge.

Frank Haskell, who was drawn away from the Oklahoma fields by the boom in the Illinois fields, and who is an oil producer in Illinois is back in Oklahoma and may remain.

John Fertig, pioneer oil man and capitalist, dies in Los Angeles, Calif., age 74 years. He had been in the oil business since 1860 and was one of the most prominent operators in the eastern fields in the first 25 years of the industry. Mr. Fertig drilled the famous "fountain well," in Venango County, Pennsylvania, the second flowing well ever struck.

Again comes the report that T. N. Barnsdall has closed the deal with a French syndicate for the sale of his properties to the Frenchmen for $16,000,000.

20 YEARS AGO

The stock of the Tide Water Oil Co. has been increased $5,000,000 and is now $30,000,000.

Royal S. Litchfield, Independence, Kans., banker and oil and gas producer, dies in Independence.

The manufacture of casinghead gasoline by the absorption process is interesting makers of that product, but while there are a number of methods, the brightest minds in the industry admit that it is yet in the experimental stage.

S. E. VanTine of Bradford, Pa., who started in the oil business as secretary to David McKelvey, one of the founders of the Tide Water Pipe Co. in 1873, dies at the age of 73.

10 YEARS AGO

The Burbank field in Osage County, Okla., is still attractive after more than five years development. Phillips Petroleum Co. paid $2,979,000 for 1,120 acres of undeveloped leases or an average of $2,600 per acre at the most recent sale.

Flood lighting for refineries has replaced old fashioned methods in six North Texas plants.

Pennsylvania grade crude oil sells for $3.90 per bbl.; Mid-Continent 36 gravity crude sells for $2.04; Gulf Coast crude for $1.25 up to $1.55.

JOHN G. PEW, general manager of the Sun Oil Company offices at Dallas, Tex., was a business visitor in Houston, Tex., the past week.

W. C. FISHER, president and managing director of Model Oils, Ltd., has returned to Calgary, Alberta, from a holiday trip to Victoria and Vancouver, British Columbia.

R. S. CAVE of the Standard Oil Company of British Columbia, Ltd., visited Calgary recently on his return to Vancouver, British Columbia, from a trip to eastern points.

BILL FLENNIKEN has been promoted to assistant to JAY TAYLOR in charge of sales for the Halliburton Cementing Company, and is being transferred to Amarillo, Tex., from Pampa, Tex.

DR. A. I. LEVORSEN, president of the American Association of Petroleum Geologists, addressed the Dallas Petroleum Geologists recently. His subject was, "Time as a Factor in the Accumulation of Oil."

ROY R. BROWN, who has been land man for the Empire Gas & Fuel Company at Amarillo, Tex., has resigned to go into leasing for himself in the Panhandle district. JOHN F. MADDOX has been moved from the Bartlesville, Okla., office to fill the vacancy at Amarillo.

JOE MONCRIEF, land man for the Tide Water Oil Company and Seaboard Oil Corporation partnership holdings in Anderson County, with headquarters at Palestine, Tex., has resigned that position to join his brother, W. A. MONCRIEF, oil operator, of Fort Worth, Tex.

THOMAS PREBODA of the Barnsdall Oil Company (California) has been transferred from Bakersfield to Los Angeles in order to superintend deepening operations on the company's No. 15 O'Dea in the Rosecrans field. Mr. Preboda has been a drilling foreman of the Barnsdall company for several years.

PARAGRAPHS

NELSON RUTH of the Carter Oil Company's Denver, Colo., headquarters made a trip into the Wyoming fields last week, including Casper in his itinerary.

C. D. SMITH, district manager of the Houston Oil Field Supply Company, is in a hospital at Corpus Christi, Tex., after suffering injury caused by a fall in that city.

OSCAR R. CHAMPION, geologist with the Amerada Petroleum Corporation, has moved from San Antonio to Pearsall, Tex., due to increased activity in the Pearsall field.

H. H. HASKELL and MISS CHARLOTTE McKINNEY, both of Titusville, Pa., were married on Saturday, March 14 at the winter home of the bride's parents, MR. and MRS. LOUIS C. McKINNEY, at Winter Park, Fla. Mr. Haskell is connected with the Haskell Pennsylvania oil interests and the bride is of the third generation of a prominent pioneer oil family. Her grandfather J. C. McKINNEY was one of the founders of the South Penn Oil Company.

JAMES DONNELL, of the Ohio Oil Company, was a New York visitor last week.

J. B. TAYLOR, superintendent of production for the Union Sulphur Company in the Mercedes field, Hidalgo County, Tex., suffered a broken leg and broken arm when a flow line from a well in the field burst. He is in the Mercedes General Hospital.

LUTHER L. CLARK, of the scouting division of the Carter Oil Company; P. F. MICHAEL, construction engineer; L. MURRAY NEUMAN, consulting geologist, and LEONARD L. TAYLOR, of the lease records division, were recently awarded 20-year Carter service buttons. The quartette have been with the Carter Oil Company almost from the beginning of the company in the Mid-Continent territory.

C. C. (PETE) WITT is a Kansan who has lived in Oklahoma since 1915 excepting during the period of the World War when he served as captain of infantry in France. From 1915 until 1917 he was with the Carter Oil Company in Tulsa and upon returning from France in 1919 joined the Parkersburg Rig & Reel Company and has been with that organization ever since as chief clerk and purchasing agent in the Tulsa office. On March 15 Mr. Witt was transferred to Wichita, Kans., and promoted to the position of manager of the Kansas subdistrict, which includes warehouses and stocks at Chase and McPherson.

R. L. PATTINSON of Chatham, Ontario, recently paid a visit to the Duck Lake area in Michigan.

JACK LAND, engineer in the Magnolia Petroleum Company's natural gasoline department, has been transferred from Burkburnett, Tex, to Electra, Tex.

CAPT. E. H. EDDLEMAN, Mid-Continent district manager, International Derrick & Equipment Company, Dallas, Tex., was a Tulsa visitor last week.

D. A. McDOUGALD, with the Sinclair Refining Company, with headquarters at New York, spent several days in the company's offices at Houston, Tex., the past week.

H. R. CULLEN, of Houston, Tex., vice president of the Quintana Petroleum Company, was appointed vice president of the Gulf Coast district of the Mid-Continent Oil and Gas Association the past week. The appointment was made by JAKE L. HAMON, president of the Texas division of the association.

THOMAS B. WILSON, oil producer and attorney at law, of Bradford, Pa., who has been sojourning in Tucson, Ariz., is expected to return home Monday. MRS. WILSON, who went to Arizona for the benefit of her health, is reported considerably improved, but will not return home until the beginning of summer.

MR. and MRS. ROBERT MARTIN McFARLIN, of Tulsa, will celebrate their fiftieth wedding anniversary on March 24. Invitations have been issued to a reception at their home. Mr. McFarlin was one of the founders and president of the McMan Oil Company which sold its holdings to the Magnolia Petroleum Company about 20 years ago for $36,000,000, and then went out and developed another large production which was sold to the Standard Oil Company (Indiana). Mr. McFarlin retired from active business some years ago.

No Barren Coast, Thanks

Until he recently became manager of production for the Standard Oil Company of Louisiana J. R. McWilliams seemed sort of anchored in Tulsa. Not that he didn't have opportunities otherwhere. But just one really interested him. That one, back in 1922, came from an English-owned oil company operating in Argentina. The idea of going to South America appealed strongly to the young engineer. He tried without much success to get information about the region to which the job would take him. Then he consulted his encyclopedia and read "the most barren section of the desolate coast of Rivadavia." He turned and with one glance took in his three-month-old baby and his wife. Then he firmly closed the encyclopedia and sent a telegram declining the position with thanks.

J. R. McWILLIAMS

Mr. McWilliams, who was born in Missouri, attended the University of Michigan. Graduating in the engineering course, he worked for a year with the Oklahoma Petroleum and Gasoline Company, Tulsa, after which he joined the Freeborn Engineering Company. In 1925 he entered the service of the Skelly Oil Company as a production engineer, leaving in 1933 to become assistant state proration umpire. On April 1, 1934, he joined the Carter Oil Company as head of its proration division, continuing in that capacity till last week, when he was appointed to his new position with Carter's affiliate, the Standard of Louisiana. His headquarters will be in Shreveport.

Mr. McWilliams married Miss Vera Seeley, of Peoria, Ill., who was at the University of Michigan when he was. She later acquired a wide reputation as a magazine and newspaper writer. They have one son.

WILSON CROSS, who recently retired as chairman of the board of the Vacuum Oil Company, Ltd., of London, will spend the next several weeks in California before proceeding to Honolulu.

D. B. COLLINS, production superintendent for the Shell Petroleum Corporation, with headquarters at Houston, Tex., made a tour of inspection through the company's holdings in Coastal Louisiana the past week.

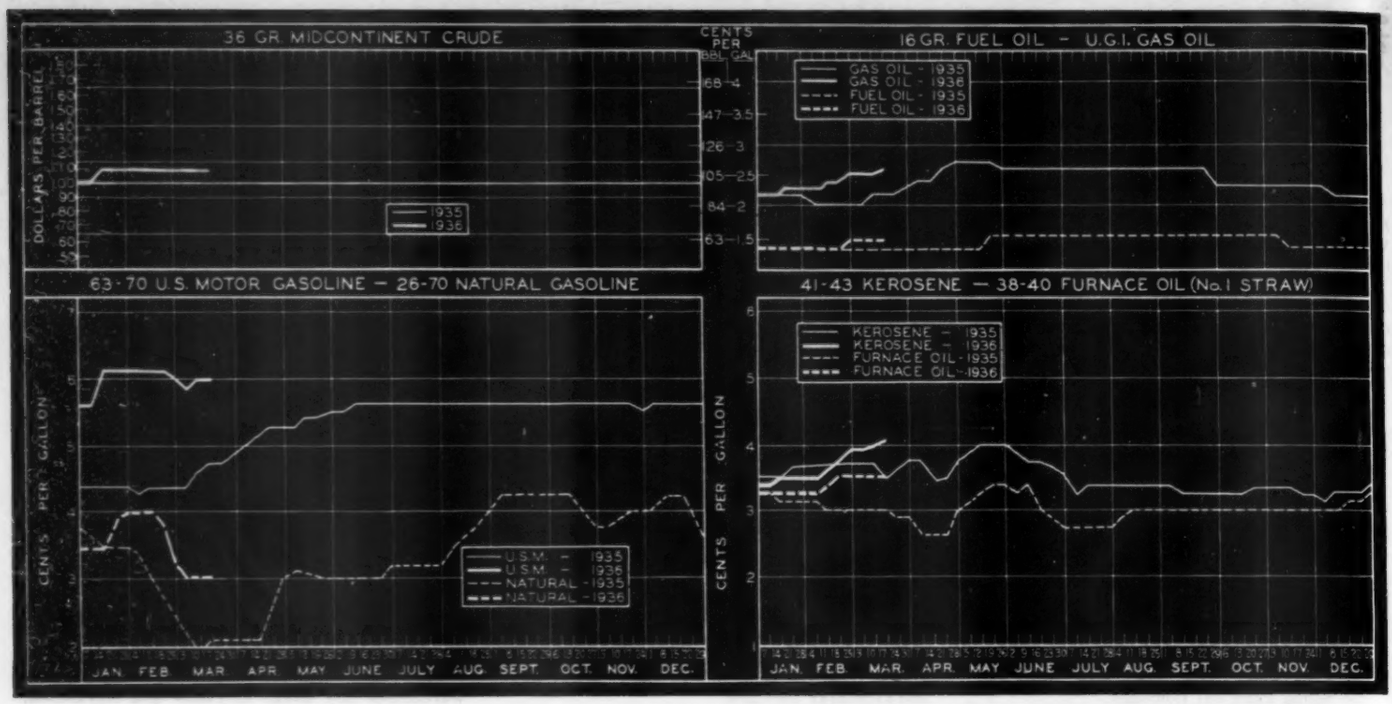
ROSS McCOLLUM was reelected president of the National Oil Company at the annual meeting held in Los Angeles, Calif., recently and at the same time J. W. SCHMID was elected a member of the board of directors.

DON MARTIN, acting deputy supervisor for the Railroad Commission at San Angelo, Tex., has been promoted to supervisor, for a number of West Texas counties. He will continue to make his headquarters in San Angelo.

G. G. CLARK, assistant warehouse manager for the Magnolia Petroleum Company, has been transferred from Electra, Tex., to Pampa, Tex., and O. D. HODGE has been moved from Archer City, Tex., to succeed Mr. Clark at Electra.

H. L. EVERSBERG, scout for the Shell Petroleum Corporation, with headquarters at Baton Rouge, La., and BAKER HOSKINS, scout for the same company with headquarters at Lake Charles, La., were business visitors at the company's offices in Houston, Tex., last week.

HARRY J. BAUER, who has numerous interests in the California oil industry, has been reelected president of the Automobile Club of Southern California and ALEXANDER B. MACBETH, president of the Southern California Gas Company, was reelected first vice president of the Automobile club.



Group 3 Motor Fuel Market Finds It Was Not So Sick as It Supposed

By T. F. SMILEY

Upon examining itself more minutely as it emerges from its nervous attack over disappointing gasoline business in January and February the Group 3 market is discovering it wasn't as sick as it supposed. Although spot motor fuel demand vanished during the protracted period of stormbound highways, it is becoming apparent that contract movement did not drop so much as was being taken for granted. One large integrated company, for instance, reported this week that figures now in hand show its February sales were only 5 per cent below those for the same month in 1935. Going far toward compensating for even this loss was the fact that fuel oil and kerosene sales have far exceeded those of 1935.

Market Problem Diminishing

Unwieldly accumulations of gasoline backed up at refineries without retail outlets of their own, but no disposition to dump these has been seen. Return of motoring weather in many regions is stimulating consumption, and this, along with the fact that runs to stills throughout the Mid-Continent territory are being sharply reduced, is causing overlarge inventories at refineries to start shrinking. Jobbers are not overstocked, and at the first sign of stiffening prices it is believed probable they will begin replenishing their supplies. With the spring pickup now near at hand, such surpluses as still remain should constitute a diminishing problem with each passing day.

A survey early this week revealed that refiners in East Texas were continuing to manufacture only such quantities of gasoline as they could sell at the going quotations. Brokers armed with orders and instructions for material obtainable at prices below these quotations reported they were unable to place the orders.

How conditions have improved in East Texas, and consequently in most other areas, was strikingly disclosed in the last week in connection with receivership sales of confiscated crude and fuel oil. Bids for approximately 6,000 bbls. of confiscated crude put up for sale in Longview ranged from 15 to 93 cents a barrel. The low bids came from hopeful but uninformed bargain-hunters; the high ones from buyers who knew times had changed. The fact 93 cents had to be paid for oil eligible for state tenders only affords pretty clear evidence that the days of cheap East Texas oil and cheap gasoline made from it are now history. A year and a half ago an East Texas refiner was regarded as lacking mentally if he paid more than 25 cents or so for crude.

Refined Oil Market Barometer

The motor fuel market is moving out of the bog into which it was dragged by weather ruinous to motor travel. Southern highways are thick with cars, and sunshine is releasing more roads daily. The demand for heating oils is slackening, but throughout the Middle West kerosene and tractor fuels are believed to be entering upon an unprecedentedly tight market.

MID-CONTINENT. Gasoline steadier. Kerosene strong. Gas oil up. Wax scarce.

EAST COAST. Fuel oil and gas oil stronger. Gasoline improved. Export markets firm.

GULF COAST. Gasoline and kerosene firm. Fuel oils off slightly.

PENNSYLVANIA. Neutrals off. Rest of market unchanged.

CALIFORNIA. Gasoline and fuel oil soft. Market generally weak.

CHICAGO. Gasoline and fuel oil strong. Kerosene and tractor fuels scarce.

In another case 60,000 bbls. of confiscated 26-gravity fuel oil was offered at a receivership sale. A local refiner's bid of 30 cents a barrel was put out of the running by another of 50 cents, which got the material. The first bidder offered the lucky one 51 cents. The offer was refused.

Truck sales of gasoline made from confiscated oil, and thus restricted to intrastate trade, are diminishing as the sources of supply are dried up.

Naturals Fairly Steady

Natural gasoline was fairly steady at quotations which have prevailed for the last three weeks. This product has entered its traditionally dull season. Notwithstanding an estimated 200,000 gallons daily output from the Texas Panhandle was eliminated by shutting down of plants there last January, the production of natural gasoline in this period of low requirement is still more than current refinery demand can take care of. The excess production is going to storage for use next fall or for export or coastwise shipment, which usually begins to pick up in July. It is pointed out that 26-70 material bought at 3 cents now will have to command at least 4 cents next fall to cover loss from evaporation and the cost of transportation, storage and interest.

As for several weeks past, kerosene and the tractor distillates provided the liveliest spots among the refined products. Many Mid-Continent refiners reported they were unable to keep up with the demand, and some of them were still buyers rather than sellers.

Wax, which has been getting stronger in recent weeks, was reported extremely scarce for spot purchase this week, and the price was up. The demand for heating oils was slackening, but prices were unchanged. Gas oil was in smarter demand in preparation for cracking operations, and quotations were higher. Bright stocks were slightly firmer. Neutrals were easier.

Gasoline Situation Improved in East; California Fuel Oil Is Discussed

NEW YORK, Mar. 16.—The first real break in the severe weather in this section came during the past week, and marketers and refiners breathed a sigh of relief. The exceptional demand for heating oils has been welcomed by the trade, but the refiners have been worried for some time by the decreasing stocks of the heavier oils and increasing supplies of gasoline. Now there is every indication the process may be reversed in the near future, or the trend at least moderated.

Stocks of fuel and gas oils at Atlantic seaboard refineries have actually reached abnormally low levels and some refiners are reported to have been seriously considering the advisability of making substantial additional purchases of California fuel oils. This may not be necessary in the immediate future because the demand is due to decrease seasonally. There is considered to be a real possibility that such purchases may be made for delivery beginning in September or October at the latest. It is admitted that Venezuela or Colombia could be called upon for larger amounts than they are now supplying, but refiners are attempting to limit importations in approximate relation to domestic production curtailment. The improvement in the price situation as related to California crude may be due in part to the outlook for finding a greater outlet for the surplus now on hand on the Pacific Coast.

There has been no change in quotations for gas oil or fuel oil. The undertone is distinctly firm. In fact, a small advance in bunker fuel prices is looked for in some quarters, possibly 5 cents per barrel. Some material is reported to have moved from the Gulf Coast at about this margin above posted prices. Marketers are reluctant to take advantage of the notably strong statistical position of the market.

Gasoline Improved

With some days of the past week strongly reminiscent of the spring season, marketers are taking heart. There is every indication the week-end will be exceptionally favorable for motoring. Dealers have been stocking up heavily in anticipation and this has tended to relieve the overstocked refiners. Should the good weather materialize, the rapid rise in motor fuel inventories will be checked in this section.

Despite the improved outlook, there has been some unsettlement in the local retail motor fuel market. Shading of retail quotations is reported in several sections, with offerings as low as 8 gallons for $1. The conclusion is some one has been caught with excess motor fuel due to the recent unfavorable weather, but the supply will soon be exhausted. The situation is not now regarded as serious.

With the big motoring season "just around the corner," Atlantic Coast marketers, at least the major ones, are preparing to put on a record educational campaign in behalf of quality motor fuels, as an extension of efforts put forth to good effect in recent years. One sales executive points out whereas material progress has been made in this direction, the industry is getting to the point, in his opinion, of realizing on this from the viewpoint of profits The industry itself, let alone the public, has been slow to appreciate the tremendous strides made in retail marketing, in quality and service. Improved quality and price both mean increased expense for the marketers.

Realize on Research

This marketer points out that 15 years ago gasoline was selling at retail at close to 30 cents per gallon. Now it is less than 15 cents. In the intervening period service stations have been provided with modern comforts, advanced equipment and every semblance of attractiveness. In the former days the motorist could never be sure of the quality of fuel poured into his tank. Today there are thousands of stations manned by courteous, intelligent workers selling the highest grades of motor fuels to give modern cars the efficient performance their makers built into them.

The oil industry has spent millions in research to produce a progressively better motor fuel, and additional millions to protect the motorist against inferior, unidentified gasolines. The sales manager referred to believes the time has come for the industry to realize on this expenditure and that it cannot afford this year to allow an excessive inventory to stand in its way.

Developments in Europe during the past week have dominated the oil export markets. Not that there has been any increased demand, but the renewed war scare again brought to the fore the possibility of emergency oil requirements and sanctions. Although the export demand for motor fuels, lubricants and other products has not been more than steady, the foreign situation has placed sellers in a favored position, with a tendency to hold out for better prices.

New York export lubricating oil prices continued to feature the situation, due not only to an urgent demand from European buyers for certain grades but also to increasing domestic requirements, which has further restricted supplies for shipment abroad. The Pennsylvania refiners find themselves in an exceptionally good position statistically, as reflected in New York prices for their material.

Cylinder stocks forged ahead to further advances, with 600 steam refined, unfiltered, now quoted for export at New York on the basis of 18½-19 cents per gallon, against 18-18½; 650 steam refined, unfiltered, at 19-19½, compared with 18¾-19¼, and other grades firm but unchanged.

Bright Stocks

Bright stocks continued unchanged in price but in much better demand, with every indication of an advance in quotations in the near future. Neutral oils, wax and petrolatum continue unchanged but firm.

Gulf export quotations for gasoline and kerosene were unchanged. Offerings are scarce and any new business might easily result in higher prices being quoted.

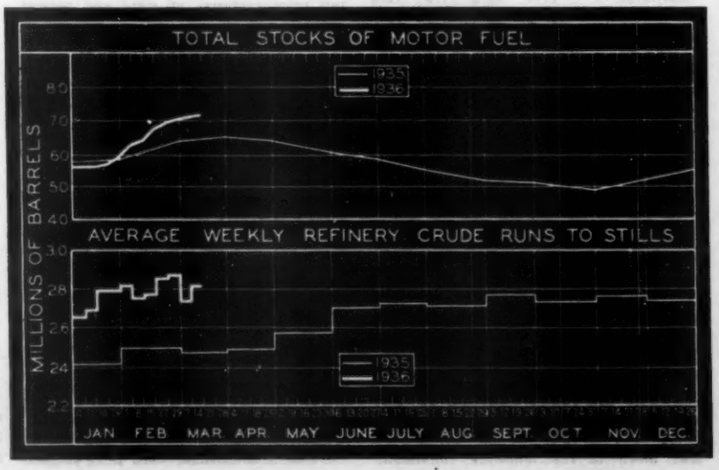
Reports apparently emanating from London that Germany would shortly be in the American market for greatly increased quantities of oil are probably based on the war scare and not on anything definite in pending orders.

A. P. I. Weekly Refinery Statistics

Week Ending March 14, 1936

	Capacity reporting (per cent)	Daily crude runs (bbls.)	Total gasoline stocks	Gas oil and fuel oil stocks
East Coast	100.0	494,000	18,172,000	6,320,000
Appalachian	94.8	110,000	2,905,000	675,000
Indiana, Illinois, Kentucky	95.9	382,000	11,484,000	2,732,000
Oklahoma, Kansas, Missouri	84.8	246,000	7,961,000	2,440,000
Inland Texas	48.5	91,000	1,927,000	1,416,000
Texas Gulf	96.8	571,000	9,440,000	6,424,000
Louisiana Gulf	96.4	130,000	1,849,000	2,473,000
North Louisiana and Arkansas	90.0	37,000	400,000	410,000
Rocky Mountains	61.9	43,000	1,647,000	704,000
California	92.6	515,000	13,372,000	70,635,000
Total reported	89.6	2,619,000	69,157,000	94,229,000
Estimated unreported	.....	196,000	3,565,000	1,633,000
*Estimated total	.....	2,815,000	72,722,000	95,862,000
*Estimated total previous week	.....	2,725,000	72,281,000	95,888,000
†March 31, 1935	.....	2,472,000	66,290,000	99,380,000

*Bureau of Mines basis currently estimated. †Monthly report, U. S. Bureau of Mines.



Gasoline Report

The A.P.I. report of gasoline consumption for December, 1935, as calculated from the Bureau of Mines monthly statistics, shows that the total consumption during that month declined from 1,491,030,000 gallons in November to 1,371,677,000 gallons. This report, which is based upon the quantity of gasoline sold or offered for sale, as reported by wholesalers or dealers in the various states, under provision of the gasoline tax or inspection laws, reflect as nearly as possible the consumption in the individual states.

The daily average for December was 44,248,000 gallons as compared with 49,701,000 gallons in November, representing a decrease of approximately 11 per cent. However, December's daily average was 7.24 per cent higher than that a year ago.

California's gasoline consumption declined from 122,809,000 gallons in November to 114,839,000 gallons: New York from 134,342,000 to 123,902,000; Illinois from 90,098,000 to 84,116,000, and Texas from 80,138,000 gallons to 79,642,000 gallons. Oklahoma's consumption increased from 26,841,000 gallons in November to 27,548,000 gallons in December. The other two states to show an increase for the month were Florida and Arizona.

RETAIL OIL MARKETS

Tank-wagon and filling station prices on gasoline and kerosene furnished by the larger marketing firms

Prices as of March 17, 1936

Taxes

The gasoline quotations given in the following tables include the 1-cent federal tax, as well as state, county and city taxes. The gasoline is the regular or standard grade. In most areas a third grade and a premium grade are also available.

Discounts

Under the standard form of commercial consumer contract which went into effect March 1, 1934, save in California, Oregon, Washington, Arizona and Nevada, a discount of 1 cent a gallon off tank-wagon or 3 cents a gallon off retail prices is permitted for purchases between 4,000 and 10,000 gallons per month, or 4 cents a gallon off retail prices for purchases in lots of more than 10,000 gallons a month. The minimum delivery is 25 gallons.

Standard Oil Co. (Indiana)

	Gasoline Tank wag.	Serv. sta.	Inc. tax	Kero. tank wag.
Chicago	14.5	16.5	4.0	9.5
Decatur, Ill.	16.0	18.0	4.0	9.5
E. St. Louis	15.7	17.7	4.0	9.5
Joliet	16.0	18.0	4.0	9.5
Peoria	16.0	18.0	4.0	9.5
Quincy	15.5	17.5	4.0	8.0
Davenport, Ia.	16.0	(†)	4.0	9.5
Des Moines	15.5	(†)	4.0	9.5
Mason City	16.2	(†)	4.0	10.0
Sioux City	16.0	(†)	4.0	9.5
Duluth, Minn.	16.5	18.5	4.0	10.6
Mankato	16.4	18.4	4.0	10.2
Minneapolis	16.4	18.4	4.0	10.2
LaCrosse, Wis.	17.4	19.4	5.0	10.2
Green Bay	17.7	19.7	5.0	9.0
Milwaukee	16.3	18.3	5.0	10.1
Madison	17.4	19.4	5.0	10.2
Detroit, Mich.	14.0	16.0	4.0	8.0
Grand Rapids	16.4	18.4	4.0	8.0
Saginaw	16.6	18.6	4.0	9.3
Evansville, Ind.	17.7	19.7	5.0	10.2
Indianapolis	17.9	19.9	5.0	10.5
South Bend	18.1	20.1	5.0	8.0
Fargo, N. Dak.	17.4	19.4	4.0	11.2
Huron, S. Dak.	17.9	19.9	5.0	8.5
Sioux Falls	17.4	19.4	5.0	8.0
Kans. City, Mo.*	15.0	17.4	4.0	8.0
Springfield	15.1	17.1	4.0	8.9
St. Louis	15.7	17.7	4.0	9.5
St. Joseph*	15.4	17.4	4.0	8.2
Wichita, Kans.	14.9	16.9	4.0	8.8
Bartlesville, Okla.	17.0	19.0	5.0	8.5

*State tax 2 cents, 1-cent city tax and 1-cent federal tax.

†Standard Oil Co. (Indiana) has leased all service stations in Iowa.

Discounts to dealers except in Iowa: 3½ cents on premium and regular and 2½ cents on third grade off service station prices; discounts to dealers in metropolitan Chicago one-half cent larger than rest of Standard of Indiana territory, namely 4 cents and 3 cents on respective grades. Dealers in Iowa sold at posted "Dealer Prices."

Stanolax Fuel Oil in Chicago

Effective February 10, 1936, f.o.b. Chicago tank-wagon prices: Range oil, less than 100 gallons, 8.75 cents; 100-149 gallons, 7.75 cents; 150 gallons and more, 7.25 cents. 1 (36-40 lt. stw, zero), less than 100 gallons, 8.75 cents; 100-149 gallons, 7.75 cents; 150 gallons or more, 7.25 cents; No. 3. (32-26 zero), less than 150 gallons, 7.5 cents; 150 gallons or more, 6.5 cents; No. 4 (22-14 zero), less than 400 gallons, 7.5 cents; 400 gallons or more, 6.5 cents, viscosity of No. 4, 35° and 100° F.; No. 5, less than 400 gallons, 5.75 cents; 400 gallons or more, 4.75 cents.

Rocky Mountain District

CONTINENTAL OIL CO.

	Gasoline Tank wag.	Serv. sta.	Inc. tax	Kero. tank wag.
Denver, Colo.	19.0	21.0	5.0	11.0
Pueblo	19.0	21.0	5.0	13.0
Grand Junction	21.5	23.5	5.0	15.0
Casper, Wyo.	19.5	21.5	5.0	11.5
Cheyenne	19.5	21.5	5.0	12.0
Butte, Mont.	22.0	24.0	6.0	17.5
Billings	20.5	23.5	6.0	16.5
Helena	22.5	24.5	6.0	17.5
Great Falls	21.5	23.5	6.0	17.5
Salt Lake, Utah	21.0	23.0	5.0	16.0
Twin Falls, Ida.	23.0	25.0	6.0	18.0
Boise	22.5	24.5	6.0	18.0
Alb'que, N. M.	21.0	23.0	*0.5	13.0

*Includes one-half cent city tax.

Discount to dealers with or without contract in Continental territory: Undivided dealer discount off service station price, 4 cents; divided dealer accounts, 3½ cents.

Southern District

STANDARD OIL CO. OF KENTUCKY

	Gasoline Tank wag.	Serv. sta.	Inc. tax	Kero. tank wag.
Atlanta, Ga.	20.5	22.5	7.0	*15.5
Augusta	20.0	22.0	7.0	*14.0
Macon	20.0	22.0	7.0	*14.5
Savannah	18.5	20.5	7.0	*13.0
Birm'ham, Ala.	21.0	23.0	8.0	12.0
Mobile	20.0	22.0	8.0	11.0
Montgomery	22.0	24.0	9.0	14.5
Jackson, Miss.	20.0	22.0	7.0	*13.0
Vicksburg	19.5	21.5	7.0	*13.0
Jacksonville, Fla.	18.0	20.0	8.0	12.0
Miami	19.5	21.5	8.0	13.5
Pensacola	21.5	23.5	9.0	12.0
Tampa	18.0	20.0	8.0	12.5
Lexington, Ky.	20.0	22.0	6.0	11.0
Covington	18.5	20.5	6.0	10.5
Louisville	19.0	21.0	6.0	10.0
Paducah	19.0	21.0	6.0	10.0

*Includes 1 cent state tax. Montgomery, Ala., has a county tax of 1 cent per gallon, and a city tax of 1 cent per gallon on gasoline, in addition to state tax; and 1 cent per gallon on kerosene. Mobile and Birmingham, Ala., each have a city gasoline tax of 1 cent per gallon. Pensacola, Fla., has a city gasoline tax of 1 cent.

Pacific Coast Territory

STANDARD OIL CO. OF CALIFORNIA

	Gasoline Tank wag.	Serv. sta.	Inc. tax	Kero. tank wag.
San Francisco	12.5	13.5	4.0	11.5
Los Angeles	12.5	13.5	4.0	10.5
Fresno, Calif.	13.0	14.0	4.0	9.0
Phoenix, Ariz.	16.5	17.5	6.0	‡16.0
Reno, Nev.	15.0	16.0	5.0	13.0
Portland, Ore.	15.0	16.0	6.0	13.5
Seattle, Wash.	15.0	16.0	6.0	13.5
Tacoma	15.0	16.0	6.0	13.5
Spokane	18.0	19.0	6.0	16.5

*Retail prices posted by Standard Stations, Inc., a subsidiary.

†Prices are at company's plant or depots, as company does not operate stations. A 4-cent per gallon discount is given dealers and customers taking tank-wagon lots except in Phoenix where discount is 1 cent.

‡Includes 5-cent state tax.

Atlantic Coast District

STANDARD OIL CO. OF NEW JERSEY

	Gasoline Tank wag.	Serv. sta.	Inc. tax	Kero. tank wag.
Atl'tic City, N.J.	14.3	17.3	4.0	9.0
Newark	14.3	17.3	4.0	7.5
Annapolis, Md.	15.6	19.1	5.0	10.0
Baltimore	15.0	18.5	5.0	8.5
Cumberland	16.6	20.1	5.0	12.7
Wash'g'n, D. C.	13.0	16.5	3.0	9.0
Danville, Va.	17.5	21.0	6.0	13.9
Norfolk	16.0	19.5	6.0	11.2
Petersburg	16.5	20.0	6.0	11.7
Richmond	16.5	20.0	6.0	11.7
Roanoke	17.5	21.0	6.0	12.9
Charles'n, W.Va.	15.8	19.3	5.0	12.6
Parkersburg	15.1	18.6	5.0	11.2
Wheeling	16.0	19.5	5.0	12.2
Charlotte, N. C.	18.7	22.2	7.0	13.9
Hickory	19.0	22.5	7.0	13.1
Mt. Airy	19.0	22.5	7.0	13.2
Raleigh	18.4	21.9	7.0	13.7
Salisbury	18.8	22.3	7.0	13.0
Charleston, S. C.	17.0	20.5	7.0	11.3
Columbia	18.2	21.8	7.0	12.6
Spartanburg	18.7	22.2	7.0	13.9

Tank-wagon gasoline refers to dealer instead of retail prices.

Price basis to dealers: Undivided dealers at regular price less one-half cent. Discount for kerosene, 1 cent off tank-wagon price for 25 gallons or more under contract (contract not necessary in Baltimore) except in New Jersey, where no discount (if necessary) is given.

Nebraska

STANDARD OIL CO. OF NEBRASKA

	Gasoline Tank wag.	Serv. sta.	Inc. tax	Kero. tank wag.
Omaha	18.4	20.4	6.0	10.1
McCook	19.1	21.1	6.0	9.5
Norfolk	18.8	20.8	6.0	10.5
North Platte	19.2	21.2	6.0	10.9
Scottsbluff	19.9	21.9	6.0	11.6

Note: Discounts to dealers: where service station gasoline prices are (maximum overall, including rent) as follows: Reliance, 2½ cents; Standard Red Crown, 3½ cents; Red Crown Ethyl, 3½ cents.

Where service station gasoline prices are below normal resellers' allowances are reduced one-half of the amount below normal, down to the following (minimum overall, including rent): Reliance, 2 cents; Standard Red Crown, 3 cents; Red Crown Ethyl, 3 cents. Discounts to consumers for tank-wagon deliveries covered only by Standard Commercial Consumers Contract, effective January 1, 1935.

Pennsylvania, Delaware and Part of New England

ATLANTIC REFINING CO.

	Gasoline Tank wag.	Serv. sta.	Inc. tax	Kero. tank wag.
Philadelphia, Pa.	17.0	19.0	5.0	9.5
Pittsburgh	17.5	17.5	5.0	10.0
Allentown	17.0	19.0	5.0	9.5
Erie	16.5	16.5	5.0	9.0
Scranton	17.5	16.75	5.0	10.0
Altoona	17.5	19.5	5.0	9.5
Dover, Del.	17.0	19.0	5.0	10.0
Wilmington	16.5	18.5	5.0	9.5
Springf'ld, Mass.	14.0	17.5	4.0	7.5
Worcester	13.0	16.5	4.0	7.75
New Haven	14.5	17.0	4.0	7.5
Providence, R. I.	11.5	15.0	3.0	7.25

Note—Tank-wagon prices are those applicable to consumers purchasing lots of 100 or more gallons in one delivery.

Central South District

STANDARD OIL CO. OF LOUISIANA

	Gasoline Tank wag.	Serv. sta.	Inc. tax	Kero. tank wag.
N. Orleans, La.	18.0	21.5	‡9.0	13.0
Baton Rouge	17.5	21.0	†7.0	11.5
Alexandria	18.5	22.0	†*8.0	10.5
Lafayette	19.0	22.5	‡*8.0	12.5
Lake Charles	19.0	22.5	†*8.0	10.0
Shreveport	18.0	20.5	†7.0	9.0
Knoxville, Tenn.	21.0	24.5	8.0	14.0
Memphis	19.0	22.5	8.0	9.5
Chattanooga	20.5	24.0	8.0	11.5
Nashville	20.0	23.5	8.0	10.0
Bristol	18.75	21.5	8.0	14.5

*Includes city tax of 1 cent.

†Includes 1-cent parish tax. ‡Includes 3-cent parish tax.

Tank-wagon gasoline refers to dealer instead of retail prices.

Price basis to dealers: Undivided dealers at dealer price less one-half cent.

Louisiana kerosene prices include 1-cent state tax.

New York and New England

SOCONY-VACUUM OIL CO., INC.

	Gasoline Post deal	Serv. sta.	Inc. tax	Kero. tank wag.
Albany, N. Y.	14.0	17.5	5.0	7.75
*Met. N. Y.:				
Manhtn., Bronx	14.2	19.2	5.0	7.25
Staten Island	14.2	19.2	5.0	7.25
Qu'ns & Br'klyn	14.2	19.2	5.0	7.25
Buffalo	14.5	18.0	5.0	8.25
Rochester	14.5	18.0	5.0	8.25
Syracuse	14.5	18.0	5.0	8.75
Boston, Mass.	12.5	16.0	4.0	7.5
Portland, Me.	14.5	18.0	5.0	7.75
Manch'ter, N. H.	14.5	18.0	5.0	8.0
Burlington, Vt.	17.0	20.5	5.0	8.75
Hartford, Conn.	14.5	18.0	4.0	7.0

*Does not include 2 per cent city sales tax which is calculated on basis of net retail price exclusive of state and federal taxes.

Southwestern District

MAGNOLIA PETROLEUM CO.

	Gasoline Tank wag.	Serv. sta.	Inc. tax	Kero. tank wag.
Dallas, Tex.	13.5	17.0	5.0	8.0
Fort Worth	13.5	17.0	5.0	8.0
Houston	15.0	19.0	5.0	8.0
San Antonio	15.0	19.0	5.0	8.0
El Paso	16.0	20.0	5.0	10.0
Muskogee, Okla.	15.0	19.0	5.0	7.0
Okla. City	15.0	19.0	5.0	8.0
Tulsa	15.0	19.0	5.0	8.0
Ft. Smith, Ark.	15.5	19.0	5.0	8.0
Little Rock	18.0	21.5	7.5	9.5
Texarkana	14.5	18.5	5.0	8.0

Naphtha

STANDARD OIL CO. (INDIANA)

	Tank wagon*
Oleum spirits	15.7
V.M.&P. naphtha	16.0
Cleaners' naphtha	15.0
Stanisol	15.0

*Prices include 3-cent Illinois tax, but not 1-cent federal tax or 2 per cent retail occupational tax.

Prices f.o.b. Chicago. Each price subject to discount of 1 cent per gallon for 150-gallon lots if covered by contract.

Ohio

STANDARD OIL CO. OF OHIO

	Gasoline Tank wag.	Serv. sta.	Inc. tax	Kero. tank wag.
Ohio points	17.5	19.5	5.0	*13.5

*Includes state tax of 1 cent.

Canada*

Imperial 3-Star Gasoline

IMPERIAL OIL, LTD.

	Gasoline Tank wag.	Serv. sta.	Inc. tax	Kero. tank wag.
Hamilton, Ont.	21.0	23.5	6.0	17.0
Toronto, Ont.	21.0	23.5	6.0	17.0
Brandon, Man.	30.8	33.8	7.0	23.4
Winnipeg, Man.	29.2	32.2	7.0	20.7
Regina, Sask.	30.5	33.5	7.0	22.0
Saskatoon, Sask.	33.3	36.3	7.0	24.8
Edmonton, Alta.	32.7	35.7	7.0	24.2
Calgary, Alta.	30.0	33.0	7.0	21.5
Vancouver, B. C.	26.0	29.0	7.0	24.0
Montreal, Que.	19.5	22.0	6.0	17.5
St. John, N. B.	25.0	29.0	8.0	19.5
Halifax, N. S.	25.0	29.0	8.0	19.5

*Imperial gallon used in Canada.

Discount to dealers: Divided dealers pay 3 cents per gallon below station price, undivided dealers pay 4 cents per gallon below station price except in cities of Hamilton, Toronto and Montreal where discounts below station price are one-half cent per gallon less.

Retail Price Changes

Standard Oil Co. (Indiana) March 12 advanced tank-wagon gasoline .5 cent and station gasoline 1 cent in Milwaukee; January 17 advanced tank-wagon and station gasoline .5 cent in East St. Louis.

Rocky Mountain Runs

Following is the daily average production of the Rocky Mountain fields for the week ended March 14:

	Bbls.
WYOMING	
Salt Creek	16,690
Big Muddy	1,540
Badger Basin	40
Byron	40
Dallas Derby	560
Dutton Creek	40
Elk Basin	640
Ferris	20
Frannie	1,540
Grass Creek	2,180
Hamilton Dome	1,000
Hudson	250
LaBarge	1,180
Lance Creek	3,520
Lost Soldier	1,410
Midway	50
Oregon Basin	1,910
Osage	600
Pilot Butte	20
Rock River	2,140
Poison Spider	90
Teapot	10
Tota Wyoming	35,470
MONTANA	
Buckley-Border	120
Cat Creek	710
Cut Bank	6,240
Dry Creek	820
Kevin-Sunburst	3,670
Lake Basin	50
Pondera	1,190
Total Montana	12,800
COLORADO	
Florence	370
Ft. Collins and Wellington	350
Iles Dome	2,730
Moffatt	380
Orchard	60
Rangely	70
Tow Creek	200
Total Colorado	4,160
NEW MEXICO	
Artesia	630
Cooper	8,320
Eunice	14,960
Hobbs	27,900
Hogback	200
Jal	3,410
Lea	950
Maljamar	1,670
Monument	3,060
Rattlesnake	770
Table Mesa	80
Total New Mexico	61,960
Total Rocky Mountain Region	114,390

W. A. Schlueter, head of the Refinery Supply Co., has returned from a month's vacation in South America and the Panama Canal Zone.

PRICES OF REFINED PRODUCTS

All quotations f.o.b. plant in cars for interstate or export movement except as otherwise noted

Prices as of March 17, 1936

The following quotations are exclusive of the federal excise taxes of 1 cent a gallon on gasoline and 4 cents on lubricating oils.

Refinery Gasoline

OKLAHOMA (Group 3)—

U. S. Motor grades:		
Below 63 octane	.05	.05¼
63-70 octane	.06	.06⅛
60-62 400 grade:		
Below 63 octane	.05	.05¼
63-70 octane	.06	.06⅛
64-66 375	.05⅛	.05⅜
68-70 360	.05¼	.05½

NORTH TEXAS—

U. S. Motor grades:		
Below 63 octane	.05	.05¼
63-70 octane	.06	.06⅛
60-62 400	.05	.05¼
64-66 375	.05¼	.05⅜

NORTH LOUISIANA (Ark., N. La. and Miss. delivery)—

U. S. Motor grades:		
Below 63 octane		.05⅜
63-70 octane	.06⅝	.06⅝
60-62 400	.05⅝	.06

ARKANSAS (Ark., N. La., Miss. del.)—

U. S. Motor grades:		
Below 63 octane		.05⅜
63-70 octane	.06⅝	.06⅝

CHICAGO (based on Group 3)—

U. S. Motor grades:		
Below 63 octane	.05	.05⅛
63-70 octane	.06	.06¼
60-62 400	.05	.05¼
64-66 375	.05⅛	.05⅜
68-70 360	.05¼	.05⅝

PENNSYLVANIA (inland refineries)—

58-60 U. S. Motor:		
Below 60 octane		.05⅝
60-64.9 octane		.07
65-70 octane		.07¼
64-66 375		.05⅝
68-70 350		.06

CALIFORNIA (domestic movement)—

54-58 U. S. Motor	.03⅝	.04⅜
58-60 400	.04½	.05¼

EAST COAST—

U. S. Motor, below 60 octane:		
*New York (Bayonne)		.06⅜
Baltimore		.06⅝
U. S. Motor, 60-64.9 octane:		
*New York (Bayonne)		.07
Philadelphia		.07
Boston		.07
Baltimore		.06⅝
Charleston, S. C.		.06⅝
U. S. Motor, 65 and above:		
*New York (Bayonne)		.07¼
Philadelphia		.07¼
Boston		.07¼
Baltimore		.07
Charleston, S. C.		.07

*All grades of gasoline one-eighth to one-fourth cent less for barge shipments. New York harbor prices are for New York and New England delivery. Prices for New Jersey delivery one-fourth cent lower.

GULF COAST (domestic)—

U. S. Motor grades:		
Below 60 octane	.05¼	.05⅜
60-64.9 octane	.05⅜	.05⅝
65 octane and higher		.05⅝

Naphtha

PENNSYLVANIA (inland refineries)—

50-52 450 (blending)		.05½
52-54 450 (blending)		.05½
54-56 450 (blending)		.05⅝

Natural Gasoline

OKLAHOMA (Group 3)—

Grade 26-70	.03	.03½
Grade 18-55	.03⅝	.04
Low vapor pressure grade:		
*14 lb. v.p. (max.)	.04½	.04⅝
*12 lb. v.p. (max.)	.04⅝	.05

*Nominal.

NORTH TEXAS—

Grade 26-70		.03
Grade 18-55	.03⅝	.03⅝

NORTH LOUISIANA (Ark., N. La. and Miss. delivery)—

Grade 26-70		.03⅝

CALIFORNIA—

75-85 375-390	.04⅝	.05½

Tractor Fuel

OKLAHOMA (Group 3)—

40-42 gr., 315-325 l.b.p., 110 flash, 540-550 e.p.	.04
41-43 gr., 300-350 l.b.p., 110-125 flash, 500-520 e.p.	.04¼
46-48 gr., 210-230 l.b.p., 480 max. e.p.	.05

Kerosene

(All kerosene water white)

OKLAHOMA (Group 3)—

41-43	.04⅛	.04⅜
42-44	.04¼	.04½

NORTH TEXAS—

41-43	.04⅛	.04¼

NORTH LOUISIANA (Ark., N. La. and Miss. delivery)—

41-43		.04¼

ARKANSAS (Ark., N. La., Miss. del.)—

41-43		.04⅛

PENNSYLVANIA (inland refineries)—

45		.05¼
46		.05⅝
47		.05⅛

CHICAGO (based on Group 3)—

41-43	.04⅛	.04¼
42-44	.04¼	.04⅜

CALIFORNIA (Pac. Coast market)—

38-40 high burning test	.03½	.05

NEW YORK (Bayonne, N. J.)—

*41-43		.05¼

GULF COAST (domestic)—

41-43	.04¼	.04½

*Barge price one-eighth cent lower.

Furnace Oil

OKLAHOMA (Group 3)—

No. 1 prime white, 38-42	.03⅝	.03⅝
No. 1 straw, 38-40	.03½	.03⅝
No. 2 straw, 32-36	.03⅝	.03½
No. 2 dark, 32-36	.03¼	.03⅝
No. 3, 28-32	.03½	.03¼
No. 3, 15 and above, 28-32	.02⅝	.02⅝

NORTH TEXAS—

No. 1 prime white, 38-42	.03⅝	.03⅝
No. 1 straw, 38-40	.03½	.03⅝

NORTH LOUISIANA (Ark., N. La. and Miss. delivery)—

No. 2, 32-36	.03½	.03⅝

ARKANSAS (Ark., N. La., Miss. del.)—

No. 2, 32-36		.03⅝
No. 3, 28-32	.03⅝	.03½

CHICAGO (based on Group 3)—

No. 1 prime white, 38-40	.03⅝	.03⅝
No. 1 straw, 38-40	.03½	.03⅝
No. 2 straw, 32-36	.03⅝	.03⅝
No. 2 dark, 32-36	.03⅛	.03⅜
No. 3, zero to 15, 28-32	.03⅛	.03⅜
No. 3, 15 and above, 28-32	.02⅝	.02½

NEW YORK (Bayonne, N. J.)—

*No. 1		.05¼
*No. 2		.04⅝
*No. 4		.04⅛

*Barge deliveries one-eighth to one-fourth cent under above, tankcar price.

Gas Oil and Fuel Oil

(Gas oil per gal., fuel oil per bbl.)

OKLAHOMA (Group 3)—

U.G.I. gas oil	.02⅝	.02⅝
No. 4, 24-28	.92½	1.00
No. 4, 15 and above, 24-28	.77½	.82½
No. 5	.70	.75
No. 6	.65	.70
Below 18 fuel oil, industrial	.62½	.67½

NORTH TEXAS—

U.G.I. gas oil	.02⅝	.02⅝
No. 4, 24-28	.92½	1.00
No. 5	.70	.75
No. 6	.65	.70
Below 18 fuel oil, industrial	.62½	.67½

NORTH LOUISIANA (Ark., N. La. and Miss. delivery)—

U.G.I. gas oil	.02⅞	.03
10-14 fuel oil, industrial	.75	.80

ARKANSAS (Ark., N. La., Miss. del.)—

10-14 fuel oil, industrial	.60	.65

CHICAGO (based on Group 3)—

U.G.I. gas oil	.02⅝	.02½
No. 4, 24-28	.95	1.00
No. 4, 15 and above, 24-28	.77½	.82½
No. 5, 18-22	.72½	.75
No. 6, 10-15	.62½	.67½

Fuel oils of more than 40 cold test generally 5 to 15 cents per bbl. in these areas.

PENNSYLVANIA (inland refineries)—

36-40	.04½	.04⅝

CALIFORNIA—

Los Angeles:

30-34 gas oil, per bbl.	1.10	1.25
27 plus diesel	1.05	1.20
27 plus diesel (bunkers)	1.15	1.25
12-16 (bunkers at tidewater)	.82	.92
10-16 (cargo lots)	.75	.85
12-17 (tankcars)	.65	.90
San Joaquin Valley:		
10-18 (tankcars)	.55	.70
San Francisco:		
27 plus diesel, per bbl.		1.25
27 plus diesel (bunkers)		1.35
10-16 (bunkers)		1.00

GULF COAST—

28-30 gas oil	.03¼	.03⅜
28-30 diesel (bunkers)		1.70
Bunker C (bulk cargoes)		.75
Bunker C (bunkers)		.90

NEW YORK (Bayonne, N. J.)—

27 plus, gas oil		.04½
28-30 diesel (lighterage 6¼ plus per bbl.)		1.65
28-30 diesel (tankers)		.04½
*Bunker C (to ocean-going ships in N. Y. harbor)		1.05
Industrial fuel (tankcars)		.04¼

*Lighterage charge 5c bbl. additional.

Bright and Steam-Refined

OKLAHOMA (Group 3)—

Bright Stocks:

190-200 D, 15-25		.20
150-160 D, 0-10		.17
150-160 D, 15-25		.16½
150-160 E, 15-25		.16
100-110 D, 0-10		.15⅝

Steam refined:

630 green (treated)		.10½
600 light green (untreated)		.09
600 dark green (untreated)	.06½	.07½

PENNSYLVANIA—

Bright Stocks (Pennsylvania grade, No. 8 color, 145-50 at 510; 540-550 flash):

10 pour test	.22	.22½
15 pour test	.21	.21½
20 pour test	.20	.20½
25 pour test	.19	.19½

Steam refined:

600	.11	.11½
650	.12½	.13
600 Pennsylvania flash	.13½	.14
630 flash	.17½	.18
600 Warren E filtered	.13½	.14

Neutral Oil

(Vis. at 100° F. except Pennsylvania and color N.G.A.)

OKLAHOMA (Group 3)—

Zero to 10 Cold Test:

150-3		.10
150-2		.11¼
180-4		.10⅝
200-2		.11⅜
200-4		.11¼
250-3		.13⅜
250-4		.13¼
280-3		.14⅜
280-4		.14⅜
300-3½		.15¼
400-3½		.16
100-2 paraffin oil		.05⅝

15-20 Cold Test:

200-3		.10⅜
200-4		.10¼
240-3		.12⅜
240-4		.12¼
280-3		.13⅜
280-4		.13

GULF COAST—

Pale Oils:

200-3	.07	.07¼
300-3	.07½	.08
500-3½	.08½	.09
750-3½	.09	.09½
1,200-3½	.09½	.09⅝
2,000-4	.09⅝	.10

Red Oils:

200-5-6	.07	.07¼
300-5-6	.07¼	.07½
500-5-6	.08	.08¼
750	.08¼	.09
1,200-5-6	.09	.09½

CALIFORNIA (moving to dom. market)

Pale Oils:

100-2½-3	.06½	.06⅝
200-2½-3	.06⅝	.07
300-3-3½	.07	.07½
400-3-4	.09	.09½
450-3-4	.09⅝	.10
550-3-4	.10	.10¼
600-3-4	.10¼	.10⅜

Red Oils:

200-4-5	.06½	.06⅝
300-5-6	.06⅝	.07
350-5-6	.07	.07½
400-5-6	.08	.08¼
450-5-6	.08¼	.08½
500-5-6	.08½	.08⅝
600-5-6½	.09	.09½
700-6½ plus	.09½	.10
750-6½ plus	.10	.10¼
900-6½ plus	.10¼	.10⅜

PENNSYLVANIA—

150 vis. at 70° F., color, 400-405 flash:

Zero pour test	.19	.19½
10 pour test	.18	.18½
15 pour test	.17½	.18
25 pour test	.16½	.17

180 vis. at 70° F., 3 color:

25 pour test	.19½	.20

200 vis. at 70° F., 3 color:

Zero pour test	.23	.23½
10 pour test	.22	.22½
15 pour test	.21½	.22
25 pour test	.20½	.21

Wax and Petrolatum

(Prices per pound)

OKLAHOMA (Group 3)—

124-126 (a.m.p.) w.c. scale		.02⅝

PENNSYLVANIA (inland refineries)—

122-124 (a.m.p.) w.c. scale	.0245	.0250
124-126 (a.m.p.) w.c. scale	.0250	.0255

NEW YORK—

Wax in bags fully refined:

123-125 (a.m.p.) wax		.0445
125-127 (a.m.p.) wax		.0455
128-130 (a.m.p.) wax		.0480
130-132 (a.m.p.) wax		.0505
133-135 (a.m.p.) wax		.0535
135-137 (a.m.p.) wax		.0560
124-126 (a.m.p.) w.s.	.0240	.0250
124-126 (a.m.p.) y.s.	.0240	.0245

Petrolatum in barrels, carload lots:

Dark green		.01⅞
Amber	.02⅞	.03
Extra amber	.03	.03⅛
Lily white	.06⅝	.06⅝
Snow white	.07⅛	.07⅜
Cream	.05⅝	.05⅝

Export Prices

GASOLINE

GULF COAST—

U. S. Motor	.05⅝	.05½
60-62 400		.05½
61-63 390		.05⅝
64-66 375		.05⅝

LOS ANGELES—

U. S. Motor grades:

53-55 octane		.04½
55-65 octane	.04½	.04½
65-67 octane	.04½	.04⅝
67-69 octane	.04⅝	.05
Above 69 octane	.05	.05½
58-60 400 endpoint	.05¼	.05⅝

KEROSENE

GULF COAST—

41-43 prime white		.03⅝
41-43 water white		.04
44 water white		.04¼

LOS ANGELES—

41-43 water white	.04½	.04⅝

LUBRICANTS

(Pennsylvania Grade)

NEW YORK (f.a.s. in bbls.)—

Cylinder Stocks:

600 Warren E		.20½
600 S.R., unfiltered	.18½	.19
650 S.R., unfiltered	.19	.19½
600 flash S.R.	.19½	.20
630 flash S.R.		.24

Bright Stocks:

8 color		.26
6½ plus color in dilution		.25½

NEUTRAL OIL

200-3 color	.27½	.28
150-2 color	.23	.23½

PARAFFIN WAX

NEW YORK (prices per pound)—

123-125 a.m.p.		.04125
125-127 a.m.p.		.0425
128-130 a.m.p.		.0450
133-135 a.m.p.		.0525
135-137 a.m.p.		.0550

Crude scale:

124-126 w.s.	.0240	.0250
124-126 y.s.	.0240	.0245

CRUDE OIL PRICES

Oklahoma, Kansas, North Central and East Central Texas

(January 9, 1936)

East Texas*	$1.15
Van, Tex.†	1.02
Altus and Tipton, Okla.‡	1.03
Other fields (see gravity table).	

*All companies. †Pure Oil Co. ‡Gypsy Oil Co.

West Texas

Crane, Upton, Howard, Glasscock and Mitchell Counties	$ .80
Winkler County	.85
Lea County, N. Mex.	.85
Pecos County*	.85
Pecos shallow†	.75

*Shell Petroleum Co., Gulf Pipe Line Co. and Humble Oil & Refining Co. †Shell Petroleum Corp.

Note—For Humble, Magnolia and Texas Co.'s West Texas and Lea County prices see gravity table. Above prices are those of other buyers.

Rocky Mountain States

(Effective January 9, 1936)

Iles, Colo., light*	$1.06
Iles, Colo., heavy*	1.00
Greybull, Wyo.*	1.28
Torchlight, Wyo.*	1.28
Grass Creek, Wyo., light*†	1.38
Grass Creek, Wyo., heavy*†	.72
Hamilton Dome, Wyo.*	.67
Elk Basin, Wyo., light*†	1.28
Frannie, Wyo., heavy*	.72
Frannie, Wyo., light (Feb. 24, 1936)*	.78
Hogback, N. Mex.*	1.21
Pondera, Mont.* (Jan. 29, 1936)	1.05
Salt Creek, Dutton Creek and Midway, Wyo., take Stanolind's Oklahoma prices on a gravity basis.	
Big Muddy, Wyo.†	1.11
Rock Creek, Wyo.†	1.13
Artesia, N. Mex. (Dec. 1, 1933)‡	.75
Maljamar, N. Mex. (Sept. 29, 1933)‡	.75
Fort Collins and Wellington, Colo.‡ (Jan. 9, 1936)	See Note
Florence, Colo.	.93
Lance Creek, Wyo.	.85
Lost Soldier, Wyo. (Sept. 26, 1933)	.63
Hudson, Wyo. (June 2, 1931)	.65
Sunburst, Mont.	1.25
Cat Creek, Mont.	1.28
Cut Bank, Mont. (May 22, 1934)	1.45

*Stanolind Oil & Gas Co. †Ohio Oil Co. ‡Continental Oil Co.

Note—Fort Collins and Wellington are not posted, price 5 cents under quotation of Salt Creek crude of like gravity (Fort Collins 36°; Wellington 33°). *Stanolind Oil & Gas Co. †Ohio Oil Co. ‡Continental Oil Co.

Southwest Texas

(January 9, 1936)

Saxet	$ .90
Mirando	.85
Pettus	1.25
Salt Flat*	.97
Salt Flat‡	.97
Darst Creek*	.97
Darst Creek†	.97
Luling	.90
Lytton Springs	1.00
Duval County	.85

*Humble Oil & Refining Co. †Magnolia Petroleum Co., Gulf Pipe Line Co. and Texas Co. ‡Shell Petroleum Corp. Saxet posted by Humble and Texas; Mirando by Humble and Magnolia; Pettus by Humble; Salt Flat by Humble; Luling and Lytton Springs by Magnolia; Duvall by Texas Co.

Middle Western States

OHIO OIL CO.

Lima (Jan. 10, 1936)	$1.35
Illinois (Jan. 9, 1936)	1.23
Princeton, Ind. (Jan. 9, 1936)*	1.22
Midland, Mich. (Jan. 13, 1936)*	1.32
West Branch, Mich. (Nov. 7, 1935)	.96
Muskegon, Mich.	1.00
Ogemaw, Mich.	1.06
Eastern Kentucky:	
Big Sandy River (Jan. 9, 1936)	1.30
Kentucky River (Jan. 9, 1936)	1.28
Western Kentucky (Jan. 9, 1936)	1.22

*Posted by Pure Oil Co., Simrall Pipe Line Co. Ogemaw and West Branch, Mich., by Simrall Pipe Line Co. Eastern Kentucky crude purchased by Ashland Refining Co., Ashland, Ky. Oceana posted by Old Dutch Refining Co. and Naph-Sol Refining Co.

Gulf Coast

(January 9, 1936)

Cleveland, Tex.	$1.10
Hardin, Tex.	1.03
Greta, Tex.	.90
Refugio, Tex., heavy	.90
Tomball, Tex.	1.30
LaFitte, La.	1.12
Livingston, Tex.	1.15
Bosco, La.	1.00
Evangeline, La.	1.07
Welsh, La.	.96

Cleveland and Hardin by Magnolia; Greta by Texas Co.; Refugio by Humble; Tomball by Humble and Magnolia; LaFitte by Texas Co.; Bosco by Pure; Evangeline and Welsh by Stanolind Oil & Gas Co.; Livingston by Shell Petroleum Corp.

North Louisiana and Arkansas

Smackover, all grades (Jan. 10, 1936)*	$ .75
Smackover, all grades (Jan. 9, 1936)†	.80
Tullos and Urania (Jan. 10, 1936)	.97
Nevada, Ark. (Jan. 10, 1936)	.65
El Dorado East Field (Jan. 16, 1936)	.75
Converse, Holly, Pleasant Hill and Zwolle (Jan. 10, 1936)*	1.10
Lisbon, Ark. (Jan. 10, 1936)*	1.10
Elm Grove, La. (Jan. 10, 1936)	.80

*Standard Oil Co. of Louisiana, Gulf Refining Co., Louisiana Oil Refining Co., Texas Co. (effective January 14) and Magnolia Petroleum Co. (effective January 16). Urania by H. L. Hunt Co. and Louisiana Oil Refining Co. Nevada by Standard of Louisiana. El Dorado East field by Magnolia Petroleum Co. Phillips Petroleum Co. (effective January 17), posts 75 cents for all grades in Union and Ouachita Counties, Arkansas.

Eastern States

TIDE WATER PIPE CO.
(Effective Jan. 13, 1936)

Bradford, Pa.	$2.45
Allegany, N. Y.	2.45

SOUTH PENN OIL CO.
(Effective Jan. 13, 1936)

Pennsylvania Grade Oil in National Transit Lines (Bradford field)	2.45
Pennsylvania Grade Oil in Southwest Pennsylvania Lines	2.17
Pennsylvania Grade Oil in Eureka Pipe Line lines	2.13
Pennsylvania Grade Oil in Buckeye Pipe Line lines	1.97
Corning Grade Oil in Buckeye Pipe Line Co.'s lines	1.43

PENNZOIL CO.
(Effective Jan. 13, 1936)

Pennsylvania Grade Oil in National Transit Lines:	
Group A — Includes Cochran, Franklin, Hamilton and Doolittle districts.	2.43
Group B — Includes Titusville district.	2.41
Group C — Includes Turkey and Tidioute districts.	2.48
Group D — Includes Bear Creek and Porkey districts.	2.38
Group E — Includes Eldeneau, Bull Creek, Rough Run, Carbon, Dipner, Brodlin, McJunkin, Jamesen, Kenerdell, Emienton, Tiona, Lacey and Kinzua districts.	2.36

Price depends on lengths of pipe line haul to plant at Oil City.

PURE OIL CO.
(Effective Jan. 13, 1936)

Cabin Creek, W. Va.	$2.12
Bradford Hollow, W. Va.	2.13
Kelly Creek, W. Va.	2.12

Canada

Ontario (Sept. 9, 1933):	
Petrolia*	$2.10
Oil Springs	2.17
Turner Valley (Feb. 3, 1936):†	
Clear naphtha	2.70
Discolored naphtha	2.46
Crude oil, 50 gravity	2.33
Crude oil, 45 to 49.9	2.12
Crude oil, 40 to 44.9	1.56

*Imperial Oil, Ltd. †Imperial Oil, Ltd., and Regal Oil & Refining Co.

Mexico

Panuco*	$ .82

*F.o.b. ship, based on February transactions and exclusive of production and export taxes and bar dues.

Robert M. Whiteside, Shell Petroleum Corp. geologist, has resigned his position with that company, but will continue to reside in Tulsa, where he will open offices as a consulting geologist.

Crude Prices by Gravities

Gravity—	Oklahoma, Kansas, and Salt Creek, Wyo.	Central and North Texas	East Central Texas	North Louisiana, Arkansas	Gray County, Texas	Carson and Hutchinson Counties, Texas	Conroe, Texas	West Texas and Lea County, New Mexico	Gulf Coast, Texas and Louisiana	Anahuac and Dickinson, Texas	Iowa and Cameron Meadows, Texas
Below 20	....	....	....	....	....	....	....	....	$ .92	....	$ .82
20-20.9	....	....	....	....	....	....	....	....	.94	....	.84
21-21.9	....	....	....	....	....	....	....	....	.96	....	.86
22-22.9	....	....	....	....	....	....	....	....	.98	....	.88
23-23.9	....	....	....	....	....	....	....	....	1.00	....	.90
24-24.9	....	....	....	....	....	....	....	....	1.02	....	.92
Below 25	$ .86	....	....	$ .78	....	....	....	....	....	....	....
25-25.9	.88	....	....	.80	....	....	....	....	1.04	....	.94
26-26.9	.90	....	....	.82	....	....	....	....	1.06	....	.96
27-27.9	.92	....	....	.84	....	....	....	....	1.08	....	.98
28-28.9	.94	....	....	.86	....	....	....	....	1.10	....	1.00
Below 29	.94	$ .84	$ .91	....	....	....	....	$ .75	....	....	....
29-29.9	.96	.86	.93	.88	....	....	....	.76	1.12	....	1.02
30-30.9	.98	.88	.95	.90	....	....	....	.78	1.14	$1.04	1.04
31-31.9	1.00	.90	.97	.92	....	....	....	.80	1.16	1.06	1.06
32-32.9	1.02	.92	.99	.94	....	....	....	.82	1.18	1.08	1.08
33-33.9	1.04	.94	1.01	.96	....	....	....	.84	1.20	1.10	1.10
34-34.9	1.06	.96	1.03	.98	....	....	....	.86	1.22	1.12	1.12
Below 35	....	....	....	....	$ .86	$ .81	....	....	....	....	....
35-35.9	1.08	.98	1.05	1.00	.88	.83	$1.24	.88	1.22	1.14	1.12
36-36.9	1.10	1.00	1.07	1.02	.90	.85	1.26	.90	1.22	1.16	1.12
37-37.9	1.12	1.02	1.09	1.04	.92	.87	1.28	.90	1.22	1.18	1.12
38-38.9	1.14	1.04	1.11	1.06	.94	.89	1.30	.90	1.22	1.20	1.12
39-39.9	1.16	1.06	1.12	1.08	.96	.91	1.32	.90	1.22	1.22	1.12
40 and over	1.18	1.08	1.15	1.10	.98	.92	1.34	.90	1.22	1.24	1.12

Magnolia Petroleum Co. in the East Texas field pays 7 cents per bbl. less than above posted prices in that field.

STANDARD OIL CO. OF CALIFORNIA

Crude oil prices at the well effective March 7, 1936

Gravity—	Signal Hill (Long Beach)	Seal Beach	Alamitos Heights	Huntington Beach	Inglewood	Playa del Rey	Olinda-Brea Canon	Athens-Rosecrans	Dominguez	Elwood Terrace	Torrance	Richfield	Whittier East Coyote (La Habra)	Montebello	West Coyote Hills	Santa Fe Springs	Mountain View	Elk Hills	Buena Vista Hills Midway-Sunset except Lakeview Area	Lakeview Area	Lost Hills	Coalinga	Wheeler Ridge	Kettleman Hills
14-14.9	$ .80	$ .75	$ .74	$ .78	$ .79	$ .80	$ .76	....	....	....	$ .80	$ .76	$ .76	$ .77	$ .78	....	..	$ .65	$ .70	$ .65	$ .70	$ .70	....	....
15-15.9	.80	.79	.74	.78	.79	.80	.76	....	....	....	.80	.76	.76	.77	.78	....	....	.65	.70	.65	.70	.70	....	....
16-16.9	.80	.79	.74	.78	.79	.80	.76	....	....	....	.80	.76	.76	.77	.78	....	....	.65	.70	.65	.70	.70	....	....
17-17.9	.80	.79	.74	.78	.81	.80	.76	....	....	....	.80	.76	.76	.77	.78	....	....	.65	.70	.65	.70	.70	....	....
18-18.9	.80	.79	.74	.78	.84	.80	.76	....	....	....	.82	.76	.76	.77	.78	....	....	.65	.70	.65	.70	.70	....	....
19-19.9	.82	.79	.74	.82	.87	.84	.81	....	....	....	.85	.76	.78	.77	.78	....	$ .70	.66	.74	.66	.74	.71	$ .70	....
20-20.9	.85	.79	.74	.85	.90	.88	.84	....	....	....	.88	.78	.82	.77	.80	....	.70	.68	.78	.68	.78	.72	.70	....
21-21.9	.88	.79	.74	.89	.93	.92	.88	....	....	....	.91	.80	.85	.77	.84	$ .78	.73	.71	.82	.71	.82	.74	.70	....
22-22.9	.92	.82	.74	.92	.96	.96	.92	....	....	....	.93	.84	.89	.79	.88	.78	.77	.74	.87	.74	.86	.78	.72	....
23-23.9	.95	.86	.77	.96	.99	1.02	.96	$ .84	$ .79	....	.96	.88	.93	.82	.92	.78	.80	.77	.92	.77	.90	.82	.76	....
24-24.9	.99	.91	.86	1.00	1.02	1.06	.99	.88	.81	....	.99	.91	.96	.85	.96	.82	.84	.80	.97	.80	.94	.86	.79	....
25-25.9	1.03	.95	.82	1.03	1.05	1.11	1.03	.93	.83	....	1.02	.95	....	.89	.99	.86	.88	.83	1.01	.83	.98	.90	.83	....
26-26.9	1.06	1.00	.85	1.07	1.09	1.16	1.06	.98	.86	....	1.05	.98	....	.92	1.03	.90	.91	.86	1.06	.86	1.03	....	....	....
27-27.9	1.10	1.06	.88	1.11	1.12	....	1.10	1.03	.88	....	....	1.02	....	.96	1.06	.95	.96	.88	1.10	.88	1.06	....	....	....
28-28.9	1.14	1.10	.90	1.14	1.15	....	1.14	1.07	.90	....	....	1.06	....	.99	1.10	.99	.99	.91	1.15	.91	1.10	....	....	....
29-29.9	1.17	1.15	.93	1.18	1.18	F.O.B.	1.17	1.12	.93	....	....	1.09	....	1.03	1.14	1.03	1.02	.94	1.20	.94	1.14	....	....	....
30-30.9	1.21	1.19	.95	1.22	1.21	our	1.21	1.17	.95	F.O.B.	....	....	....	1.07	1.17	1.08	1.06	.97	1.25	.97	1.18	....	....	....
31-31.9	....	....	....	....	1.24	Pipe	1.24	1.22	.97	Ship	....	....	....	1.11	1.21	1.12	1.09	.99	1.29	.99	....	....	....	....
32-32.9	....	....	....	....	1.27	Line	1.27	1.27	1.00	....	....	....	....	1.14	1.25	1.16	1.13	1.02	1.34	1.02	....	....	....	....
33-33.9	....	....	....	....	....	....	....	1.32	....	$1.28	....	....	....	1.18	1.28	1.20	1.17	1.04	1.38	1.04	....	....	....	$1.19
34-34.9	....	....	....	....	....	....	....	1.37	....	1.32	....	....	....	1.22	1.32	1.25	1.20	....	....	....	....	....	....	1.23
35-35.9	....	....	....	....	....	....	....	1.42	....	1.35	....	....	....	1.25	....	1.29	....	....	....	....	....	....	....	1.27
36-36.9	....	....	....	....	....	....	....	1.46	....	1.39	....	....	....	1.29	....	1.33	....	....	....	....	....	....	....	1.31
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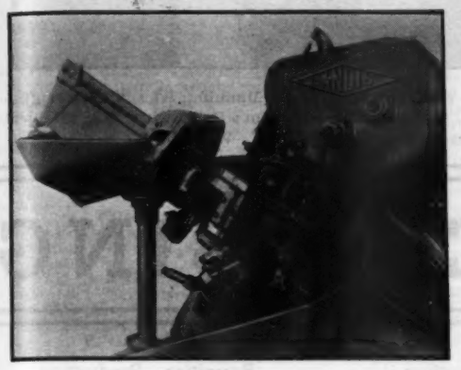
Newhall, McKittrick, Kern River and Round Mountain 70 cents for all grades. Kern Front 70 cents for all grades.

NEW OR IMPROVED EQUIPMENT

Landis Forming and Threading Machine Is Magazine-Fed

With the Landis automatic forming and threading machine, manufactured by Landis Machine Co., Waynesboro, Pa., the bolts usually are fed into



the transfer mechanism automatically from a hopper. The machine will feed automatically bolts from three-sixteenths inch to 1-inch diameter, with thread length up to 2½ inches and bolt lengths from 1 inch to 6 inches.

To provide for increasing the capacity of the machine to take bolts longer than 6 inches, a magazine feed has been designed. The magazine will handle bolts up to 7¼ inches long, the maximum length which can be taken by the transfer mechanism. By removing the hopper leaf the magazine can be attached directly to the hopper. The installation, therefore, can be made to machines in service.

The bolts must be placed in the feeding chutes of the magazine by hand, after which they are automatically fed to the grippers, pointed, threaded, and ejected. All factors remaining equal (diameter, pitch, thread length, and cutting speed), production will be identical with that of regular machine equipped with hopper leaf for fully automatic feeding.

Bulletins, Booklets and Other Literature for the Trade

Edward Valve & Manufacturing Co., East Chicago, Ind., has its catalog No. 11 ready, telling about Edward valves. It consists of nine sections and a contents chart, some 240 pages.

An article on corrosion of air-conditioning ducts, by Ralph W. Baker, metallurgical engineer for Republic Steel Corp., Cleveland, Ohio, has been printed for distribution by that company.

A four-page illustrated bulletin, No. 354, prepared by Bethlehem Steel Co., Bethlehem, Pa., describes two types of paving plates, designed for use on roadways, plant floors, loading platforms and docks. Sketches provide instruction details for installation.

The Haynes Stellite Co., Kokomo, Ind., announces an eight-page booklet, "Haynes Stellited Valves." Increased life and economy resulting from the application of Haynes Stellite to the seating surfaces of valves for high-temperature, high-pressure steam service are described.

For those interested in a simple variable speed device, bulletin No. 1261 is now available on Allis-Chalmers new Vari-Pitch Texrope sheaves.

Calculation of the pump output, or what is called water horsepower in the case of water pumps, is complicated when testing high-pressure pumps pumping hot oils. The procedure, including necessary formulas, is described in full in the current issued of the News Letter, published by Byron Jackson Co., Berkeley, Calif.

Electric welding products, electrodes, arc welding machines, and miscellaneous apparatus, are described and illustrated in a 32-page book issued by Air Reduction Sales Co., 60 East Forty-second Street, New York.

"Lead Roofing Past and Present" is among interesting articles in the current issue of the Dutch Boy Quarterly, published by National Lead Co., 111 Broadway, New York.

A 24-page booklet sent on application to A. B. Chance Co., Centralia, Mo., discusses correct anchoring and how to figure strains on guys.

Truck and trailer size and weight restrictions of all states are compiled in convenient form in a booklet obtainable on request from the Four Wheel Drive Auto Co., Clintonville, Wis.

Men Widely Known in the Equipment Field

John B. Jenkins, district manager of the Oklahoma branch of the Twin Disc Clutch Co., recently opened at 310 East Fourth Street, Tulsa, has been connected with the organization 10 years. He has taken a leading part in improving the de-

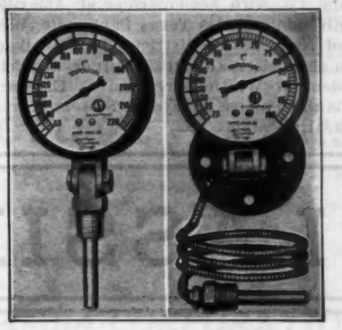
JOHN B. JENKINS

sign and construction of friction clutches to meet the increasing demands for efficient power control in drilling, pumping, and other oil field service.

Before joining Twin Disc Mr. Jenkins was active in the development of gasoline tractors for agricultural and industrial purposes. For years he was superintendent of the Monarch Tractors, Inc., and before that was designing and experimental engineer with several machinery manufacturers.

Universal Socket Thermometer Is Put on Market by Marsh

The Marsh Universal socket dial thermometer manufactured by James P. Marsh Corp., 2073 Southport Avenue, Chicago, is offered in both the



self-contained type and in the distant-reading type.

The type 61 self-contained instrument, fitted with the Marsh Universal socket, permits use as a vertical connection thermometer, a 90-degree back-angle thermometer, a front-angle thermometer or any intermediate angle. It eliminates the requirement of specifying a particular type of stem for each separate application.

The type 62 distant-reading thermometer is standard with 6 feet of connecting tubing and a union bulb or, in the case of high-temperature thermometers, either a union bulb or a flexible plain bulb. The thermometer has a mounting flange together with the universal socket which permits the installation of the instrument proper at any convenient point on top or in front of the apparatus or on a wall or pillar, then installing the bulb right at the point of temperature.

A complete assortment of Fahrenheit scale ranges for all requirements from 20 degrees below zero to 800 degrees above zero or corresponding Centigrade scales is available.

Covic Acquires Victor Rights

Covic Diesel Engine Co., Cotton Exchange Building, Los Angeles, Calif., has acquired the American manufacturing and distribution rights under American patents for the English Victor horizontally opposed diesel engine, which it manufactures and markets under the name of Covic diesel engine. These little diesel engines are reported in use in over 20 types of application throughout the world. They are said to be especially adapted for electric generation and are supplied with either hand control or full automatic. They are also fitted for use with road machinery, hoists, compressors, welders, drag lines, miscellaneous vehicle adaptations, concrete mixers, standby plants, auxiliaries for larger diesel engines, oil field uses, pumping water and oil, and general industrial work.

New Underground Insulation

A new insulation, Adsco cell-concrete, for underground steam and hot-water pipe lines, possessing low heat conductivity and the ability to retain its physical strength and shape as well as completely regain its insulating value after repeated submergence in water, is offered by the American District Steam Co., North Tonawanda, N. Y. This insulation is made entirely from portland cement mixed with a foam, producing a lightweight cellular concrete of a specific gravity of approximately 0.3. It can be fixed on the job and poured around pipes in conduits of various constructions resulting in a rigid, permanent installation.

Crude Oil Stocks

Grade of crude oil—	Feb. 22	Feb. 29
Pennsylvania Grade	3,963,000	3,972,000
Other Appalachian	826,000	818,000
Lima-N.E. Indiana-Michigan	1,175,000	1,088,000
Illinois-S.W. Indiana	10,763,000	10,671,000
N. Louisiana and Arkansas	9,233,000	9,196,000
West Texas and S.E. N. Mex.	28,530,000	28,123,000
East Texas	19,691,000	20,396,000
Other Mid-Continent	128,984,000	127,542,000
Gulf Coast	25,833,000	25,652,000
Rocky Mountain	26,569,000	26,591,000
California	36,440,000	35,729,000
Foreign	3,179,000	3,256,000
Total reported weekly	294,215,000	293,044,000
Estimate of unreported stocks	16,450,000	16,400,000
Total stocks	310,665,000	309,444,000

C. A. Daniels has been appointed superintendent of the new western division of Phillips Petroleum Co. with headquarters at Amarillo, Tex. The division includes Texas Panhandle, West Texas and New Mexico districts. Jack Walker is division chief clerk, George J. Turner, district superintendent at Whittenburg, and C. E. Sturdivant, foreman at Pampa. Floyd M. Stevenson was made technical assistant.

NEW HOUSTON OIL FIELD MATERIAL CO. OFFICERS

New directors of Houston Oil Field Material Co., with exception of M. Manning, who is a vice president: George O'Leary, president; Ed Robertson, executive vice president; Bob Ewing, vice president and assistant secretary-treasurer; J. E. Peters, secretary-treasurer; A. W. Waddill, director.

CLASSIFIED ADVERTISING

For Sale—Maps

OFFICIAL NOMENCLATURE MAPS
Kansas — Oklahoma — Texas
E. C. JACOBSON
PHONE 4-5419 530 McBIRNEY BLDG. TULSA, OKLA.

UP-TO-DATE OWNERSHIP MAPS all active West Texas Counties and east half Lea Co., N. M. Send $1.00 for new map of State of Texas and Eastern N. M., showing oil and gas fields.
ZINGERY OIL MAP CO.
Fair Building, Fort Worth, Texas.

Royalties—Production

Brokers—Salesmen

Sell in the most active area in the United States — The Permian Basin of West Texas and Southeastern New Mexico. From the standpoint of royalty investors this area has much to offer. Can supply you with choice non-producing royalties located on geophysical highs. Also drilling blocks, close in acreage to production, or wildcat leases. I maintain my own field men who cover this area for me. All offerings meet the requirements of the Securities and Exchange Commission. Inquiries invited.

B. D. BUCKLEY
Paul Brown Bldg., St. Louis, Mo.

ROYALTIES and leases in all fields, producing and nonproducing, Kans., Okla., Tex. Get my list before buying. JAMES R. HAYNES, Grantville, Kans.

FREDERICK A. SANSOME AND COMPANY
522 Fifth Avenue
NEW YORK, N. Y.
Will buy, sell or quote.
Oil Interests. Wholesale Only.

FOR SALE: Drilling blocks 5000 acres up. Miller, Lafayette, Nevada and Columbia Counties, Arkansas. Titus, Cass and Bowie Counties, Texas. Maps and details. Write Ark-La-Tex Resource Co., Inc., Texarkana, U. S. A.

For Sale—Maps

HIGH GRADE producing oil and gas royalties offered to dealers. Billie Smallwood, P. O. Box 2261, Tulsa, Oklahoma.

EXTENDING FLORIDA PROGRAM
Drilling Blocks Supported by Geophysics, Geology and Financial Assistance Now Ready. Responsible Independent Operators Contact.
OIL DEVELOPMENT CO. OF FLORIDA
Groveland, Florida.

I BUY AND SELL oil royalties and producing wells, East Texas field. B. A. SKIPPER, Longview, Texas.

Royalties—Production

ANDREW J. BARRETT
The Philtower
Tulsa. Oklahoma.

PRODUCING OIL ROYALTIES
Bought (Wholesale) Sold.
Inquiries invited from Oil Companies, Bankers, Dealers.
JOHN J. KOEHLER
20 Broad St. New York.

PRODUCING OIL ROYALTIES
for dealers.
H. P. BOWEN
842 Kennedy Bldg., Tulsa, Okla.

Van—East Texas—Louisiana Royalties
Bought—Sold.
WILLIAM MONROE LAYTON
67 Wall St., Suite 1510 New York City.

I own and offer subject prior sale
DOBBS—A. F. BRAY—WARD COUNTY, TEXAS
OVER-RIDING ROYALTY
The allowable of 100 bbls. per day makes this royalty an attractive purchase at $100 per O. R. Royalty acre, New York delivery and payment.
Wire your orders.
W. E. HOUSEL
76 BEAVER ST. NEW YORK CITY.

Royalties—Production

MONTHLY PAYING ROYALTIES on which we have filed SCHEDULES A with the SEC at WASHINGTON. Quoted Dealers Exclusively.
W. E. COOK
Suite 812, Palace Bldg., Tulsa, Okla.

PRODUCING OIL ROYALTIES
(ALL FIELDS)
Bought, Sold and Quoted.
HENRY L. BAKER CO.
207 Van Nuys Bldg.,
Los Angeles, Calif.
Telephone Trinity 7391.

VAN POOL — EAST TEXAS
Bought — Sold — Wholesale.
W. R. Brown & Co., Inc.
14 Prospect Pl., East Orange, N. J.

NEW OIL and Gas Structures located for you by the Quickest and Most Economical Method known. The Mid-West Development Co., 423 Cuyahoga Building, Cleveland, Ohio.

PRIME POTENTIAL ROYALTIES under and/or offsetting drilling wells. Wholesale exclusively. L. E. Morency, Hunt Building, Tulsa, Oklahoma.

Financing

JAMES E. MILLER, 604 W. Seventh St., Tulsa, Okla., will aid in financial marketing problems. Fee basis.

PROSPECTUSES prepared and dealshaped up for registration or exemption under Federal Security Act. Fee basis. John Morris, Box 5411, Philadelphia, Pa.

Patent Attorneys

REGISTERED PATENT ATTORNEYS
United States and Canada
Before disclosing your invention to anyone, send for blank form:
"Evidence of Conception."
Instructions "How to Establish Your Rights" and complete information FREE!
LANCASTER, ALLWINE & ROMMEL
418 Bowen Building,
Washington, D. C.

Incorporations

CHARTERS — Delaware best, quickest, cheapest, most liberal. Free forms. Colonial Charter Co., Wilmington, Del.

DELAWARE CHARTERS: Complete incorporating and organizing service $35. Submitted forms. Chas. G. Guyer, Inc., Wilmington, Del.

Mailing Lists

OF ROYALTY investors by deed, guaranteed. Oil Industry Mailing List Co., Tulsa Loan Building, Tulsa, Oklahoma.

ROYALTY OWNERS
Names and addresses in any State. Royalty Lists, Box 105, Ft. Worth.

Petroleum Eng. Laboratories

GEOLOGIC STANDARDS COMPANY
1600 East 5th Place, Tulsa, Oklahoma.
Porosity-Permeability-Saturation Tests.

CLASSIFIED DISPLAY RATES

Classified Display is set with a border and may be used in one or two column sizes.

1 Inch	*1 time*	*$5.00*
1 Inch	*13 times*	*4.50 per inch*
1 Inch	*26 times*	*4.00 per inch*
1 Inch	*52 times*	*3.50 per inch*

This space may be contracted for over a period of one year from the date of the first insertion and is PAYABLE IN ADVANCE, MONTHLY

CLASSIFIED RATES

Classified advertising rates: First insertion, 35 cents a line; each additional insertion, 25 cents a line, PAYABLE IN ADVANCE. Six words usually make a line. Count as a word each one-letter word and each group of figures. White space computed at regular line rate. Allow two extra lines for blind ads. Ads of less than three lines not accepted. No formal acknowledgment is made, and proofs cannot be shown in advance of publication.

	1 time	2 times	3 times	4 times		1 time	2 times	3 times	4 times
3 Lines	*$1.05*	*$1.80*	*$2.25*	*$3.30*	*7 Lines*	*$2.45*	*$4.20*	*$5.95*	*$7.70*
4 Lines	*1.40*	*2.40*	*3.40*	*4.40*	*8 Lines*	*2.80*	*4.80*	*6.80*	*8.80*
5 Lines	*1.75*	*3.00*	*4.25*	*5.50*	*9 Lines*	*3.15*	*5.40*	*7.65*	*9.90*
6 Lines	*2.10*	*3.60*	*5.10*	*6.60*	*10 Lines*	*3.50*	*6.00*	*8.50*	*11.00*

We reserve the right to withhold all advertising of questionable character. To avoid delay be sure to send remittance with copy. We will set your ad in the smallest amount of space possible and refund all overpayments. One-time insertions will not be run until fully paid. Forms close MONDAY NOON before each issue date.

THE OIL AND GAS JOURNAL
Tulsa, Oklahoma

Used Refinery Equipment

Dismantling two large modern refineries located in Oklahoma and Texas. Everything from a Cracking Still to a Filling Station Pump. Thousands of items. Send for latest illustrated catalog. Get our quotations and see how much you save.

BROWN-STRAUSS CORPORATION

Main Office—1446 Guinotte Ave., Kansas City, Mo.

Branches

Sapulpa, Okla. Arkansas City, Kans. Pyote, Texas.

FOR SALE

2—Heavy Standard Rigs, 6' irons, 84' derricks, one all steel, other steel derrick, with or without tools.
1—140 H.P. Buffalo Gasoline Drilling Engine, mounted on trucks, complete with reverse and brake.
1—75 H.P., 220 volt Drilling Electric Motor, complete with control panel.
Chicago delivery and inspection.

WILLIAM H. CATER
2643 W. Monroe St.,
Chicago, Illinois.

FOR SALE

2—80 H.P. Bessemer direct driven tandem compressors. 12" low, 7" high cylinders. (Ideal for repressuring.)
2—80 H.P. Bessemer direct driven compressors, 14" cylinders.
6—7' x 27" gasoline storage tanks.
Other gasoline plant equipment.

P. O. BOX 322
TULSA, OKLAHOMA.

25 K.W. and 40 K.W. Gas Engines, 220 volts, D.C. Two 100 K.W. Gas Engine-Generator Sets, 220 volts, D.C. 7x6 Ingersoll-Rand ER-1 Air Compressor. Six-inch Oster Pipe Threading Machine. Also large stock of lathes, pipe machines, milling machines, etc. Send for our list.

Terms to suit.

CINCINNATI MACHINERY & SUPPLY CO.
26 West 2nd St. Cincinnati, Ohio.

DIESEL Engine for Sale. 225 H.P., 360 R.P.M. Chicago Pneumatic Tool Engine Direct Connected to G.E. 2,300 Volt, 187 K.V.A. Generator. Purchased Summer 1933. Run less than thirty-five hundred hours. Engine junk. United Power Company, 1105 First National Building, Oklahoma City, Oklahoma.

SEVERAL USED ROTARY RIGS
Spudders and Drilling Machines.
Several Steel Derricks & Rotary Equip.
J. S. Daniel, Beacon Bldg., Tulsa.

FOR SALE—Okell drlg. outfit comp. Good condition. Loc. Albuquerque, N.M. J. W. Dewey, 321 W. 8th, Los Angeles.

SIX REBUILT Oxweld Cutting and welding Outfits—Torches, Gauges. Reasonable. Service Co., 3732 Cedar Avenue, Cleveland, Ohio.

FOR SALE—Air Compressor Laidlow-Dunn Gordon, 12x18—12x12 double cylinder steam driven. I. Jaffee & Sons, Dallas, Texas.

FOR SALE—Three portable Southwestern absorption gasoline plants complete. Globe Gasoline Company, Blackwell, Oklahoma.

FOR SALE—5 x 10 Gaso portable pumping unit powered with Hercules motor. General Machine & Supply Co., Wichita Falls, Texas.

Situations Wanted

15 YEARS experience, production superintendent with major oil company desires situation in production department. References. Address Box H-184, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPERIENCED SALES ENGINEER, 10 years experience in valve industry, 3 years purchasing and transportation experience. Capable branch office management. Age 34. References. Address Box H-180, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST—14 years consultant, familiar with all phases of oil and gas production, available April 1st, on interest and expense basis only. Leonard, 2614 Victor, Kansas City, Mo.

MANUFACTURERS REPRESENTATIVE: Well acquainted with purchasing agents and superintendents in Mid-Continent area, would like to acquire specialty and machinery lines. Capable of opening and maintaining office and warehouse and organizing sales force. Exceptional background in organization and management. Address Box H-181, The Oil and Gas Journal, Tulsa, Oklahoma.

Situations Wanted

CHEMICAL Engineer, petroleum chemist, with outstanding mechanical engineering experience in designing and developing equipment, wants position with engineering, development or operating department of major oil refining unit or oil producing interest. Address Box H-142, The Oil and Gas Journal, Tulsa, Oklahoma

REFINERY SUPERINTENDENT — Graduate chemical engineer, 9 years experience design, construction, operation of cracking, skimming, road oil, asphalt, treating, vapor recovery plants. References. Address Box H-193, The Oil and Gas Journal, Tulsa, Okla.

Help Wanted

GAS PLANT ENGINEER

An Eastern petroleum equipment manufacturer requires an engineer who thoroughly understands physical chemistry, has the personality and appearance for sales engineering, and has had practical natural gasoline plant experience. State training, experience, age, salary expected and enclose a photograph. Address Box H-185, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED—A salesman to sell bleaching clays to oil refineries and drilling mud to oil producers in Texas and Oklahoma. State qualifications, experience, and references. Address Box H-192, The Oil and Gas Journal, Tulsa, Okla.

Business Opportunities

GEOLOGIST desires connection on percentage basis plus expenses. Highest credentials. Address Box G-823, The Oil and Gas Journal, 415 Lexington Avenue, New York City.

Practical Refinery Engineer will build plant for portion of stock, and operate plant for share of net profits and expenses in each case. Address Box H-191, The Oil and Gas Journal, 809 Sterling Bldg., Houston, Texas.

DRILLING MUD — High absorption, viscosity and gravity. One-third heavy metallic oxides. Correspondence with distributors and heavy users invited. E. P. HUNTER, Bedford, Indiana.

Leases—Production

NEW MEXICO Oil and Gas Leases and royalties. Send 50 cents in stamps for new State Oil Map of New Mexico. Roy G. Barton, Clovis, New Mexico.

FOR SALE—40,000 acres, oil leases in Kit Carson, Cheyenne and Kiowa Counties, Colo., 10 yr. leases 25c per acre rental, rentals paid for 1 yr. I furnish leases anywhere in Colo. or Kans. A. P. Tone Wilson, Burlington, Colorado.

WINKLER County, Texas, 640 acres, Sec. 24, Blk. 77, drilling on two sides. Will sell 5 year lease or ¼ of the royalty. H. T. Jones, 419½ W. Rio Grande, Fort Worth, Texas.

DEALERS — BROKERS

New form of Oil Investment especially suitable for small and large investors. Issued against producing wells only. No assessments or development expense. Exceptional return. Wells located in long life prolific area. Attractive price and steady return insures continuing customer demand. Limited number of selected dealers will be appointed.

Write or wire for full information.
W. E. HOUSEL
Field Office:
1212 City Bank Bldg. 76 Beaver St.
Shreveport, La. New York City.

Oil leases or Royalty, Drilling Propositions anywhere in Central Oklahoma.
I. H. TOWNSEND
P. O. Box 603, Shawnee, Okla.

Everything in Refinery Equipment

The Altitude Refinery at Chanute, Kansas.
The Marathon Refinery at Boynton, Oklahoma
The Sinclair Refinery at El Paso, Texas.
The Pure Oil Refinery at Ardmore, Oklahoma.

Everything for sale in these plants. ALL of our EQUIPMENT is RECONDITIONED. Inventories on request. Pressure tanks and Hot Oil Pumps our specialty.

Wire — Phone — Write

W. C. BERRY —or— H. J. GALAMBA

SONKEN-GALAMBA CORPORATION

64 North Second Street Kansas City, Kansas.

Steel Storage Tanks

We will erect latest type 55,000 bbl. all steel storage tanks at a great saving. Over 500 tanks on hands from 500 bbls. to 80,000 bbls.
Four 55,000 bbl. all steel tanks near Seminole, Oklahoma, for rent, we own ground and pipe connections.

We can furnish any quantity of steel tank sheets from 3/16 inch to ½-inch inclusive in carload lots at bargain prices.

Wire—Phone—Write—W. C. Berry

SONKEN-GALAMBA CORPORATION

64 North Second Street Kansas City, Kansas.

Hot Oil Pump Bargains

4—10" x 9" x 12" Horizontal, Duplex, Hot Oil Pumps, manufactured by the Dow Pump & Diesel Engineering Co., Ball valves of stainless steel, capacity 210 g.p.m. against 35 lbs. pressure, for oil having a temperature as high as 900°, located at Ardmore, Oklahoma.

SONKEN-GALAMBA CORPORATION

64 North Second Street Kansas City, Kansas

Steel Plates at Special Prices

Ready for immediate shipment 3/16 to ½-inch flat sheets, sizes 5 x 10, 5 x 15 and 5 x 20 feet. Steel in excellent condition and good as new in every respect. Prices upon application. Write, phone or wire W. C. Berry.

SONKEN-GALAMBA CORPORATION

64 North Second St. Kansas City, Kansas

PRESSURE VESSELS

2—Vogt reaction chambers—10' x 18' x 2⅜" steel.
3—Dephlegmators 42" x 21' x ¾" steel.

SONKEN-GALAMBA CORPORATION

64 North Second Street, Kansas City, Kansas.

Leases—Production

FOR SALE, OIL AND MINERAL RIGHTS, under lands in Eastern Colorado, leased in solid blocks, largely by major companies; taken after seismic surveys and core drillings. Titles clear. Get ready for the next big oil play. Warren Shamburg, Burlington, Colorado.

LEASES and Royalties for sale. Rodessa, Sligo and Bethany area. Also have choice North Louisiana drilling block where opportunity is ripe. A. D. King, with Bi-State Oil Co., Inc., 538 Ricou-Brewster Building, Shreveport, Louisiana

DRILLING BLOCK—I have block to requirements on well defined Geologic structure, Ashley Co., Ark. Who will drill same on acreage basis? Box 197, Hamburg, Ark.

Would lease for oil and gas, land in Prowers County, Colo. A. W. Hanson, 812 Marion St., Denver, Colorado.

FOR SALE—Interest in 3,500 acres or part very desirable oil leases to create drilling fund. No consideration under $20.000. Address Box H-170, The Oil and Gas Journal, Tulsa, Oklahoma.

Leases—Production

Clay Deposits Suitable for Decolorizing Lubricating Oils are Valuable. Samples of two commercial clays 25 cents postpaid. Determination of the decolorizing power of raw clay $10.00. Pound sample required. W. C. Talley, 240 Gordon Arcade, Cleveland, Ohio.

Leases and royalties and two well located blocks in Lane County, Kansas. J. E. Mowery, Dighton, Kansas.

NEW MEXICO—My weekly scout report furnishes complete and reliable information on New Mexico developments. Send for copy. W. S. Patterson, Santa Fe, New Mexico.

LANDS, Leases, Royalties, anywhere, bought, sold. Lands, $2 acre, up. Leases 25c acre, up. Advise needs. American Investment Co., Houston, Texas.

Oil Industry Printing

OIL FIELD LEGAL BLANKS

Leases, assignments, releases, township plat books, well records, etc. Request on your letterhead gets free catalog. Olds Press, 215 East Third St., Tulsa, Okla.

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March

19-21—Tulsa, American Association of Petroleum Geologists, twenty-first annual meeting.

April

6-7-8—Excelsior Springs, Mo., Western Petroleum Refiners Association, Elms Hotel.

9-10—Shreveport, La., A.P.I., southwestern Division of Production, Washington-Youree Hotel.

11-13—Tulsa, Petroleum Industry Electrical Association.

13-17—Kansas City, Mo., American Chemical Society, Petroleum Division, Symposium on Motor Fuels.

14—Los Angeles, Calif., A.P.I., Division of Production, spring meeting.

14-18—Detroit, Mich., Oil Burner Institute.

16-18—Cleveland, Ohio, National Petroleum Association, semiannual meeting, Cleveland, Hotel.

20-25—Houston, Tex., Oil Equipment and Engineering Exposition.

May

5-8—Dallas, Tex., A.G.A. Natural Gas Department, Baker and Adolphus Hotels.

13-15—Tulsa, midyear meeting, American Petroleum Institute, Mayo Hotel.

13-15—Tulsa, Natural Gasoline Association of America, fifteenth annual convention, Hotel Tulsa.

15—Tulsa, Institution of Petroleum Technologists, American Meeting, Mayo Hotel.

16-23—Tulsa, International Petroleum Exposition and Congress.

21—Tulsa, Independent Petroleum Association of America, midyear meeting.

22—Tulsa, National Stripper Well Association.

25-27—New York, A.G.A. Production and Chemical Conference.

25-28—New Orleans, La., National Association of Purchasing Agents Convention.

June

17-20—Dallas, Tex., American Society of Mechanical Engineers.

18-19—State College, Pa., Pennsylvania Grade Crude Oil Association, thirteenth annual meeting.